

Concrete

Vol. 37

Chicago, December, 1930

No. 6

Concrete Units Win Way Into Large Buildings

Manufacturer Puts Concrete Masonry Into Large Buildings—Necessary to Conquer Field Already Occupied by Other Masonry Materials—Sold on Quality Rather Than Price—Automatic High-Production Equipment Employed—Tests That Convince Architects

By **RUSSELL ACKER**

Vice-President and General Manager, Acker Cement Products & Supply Co., Ft. Wayne, Indiana

TODAY the biggest problem facing the manufacturer of concrete masonry units or any other concrete products is that of expanding his market. He can expand his market only by selling his product for purposes for which it has not generally been used before. That means that a market already occupied by other building materials must be invaded.

That was our problem in Fort Wayne. We saw the need

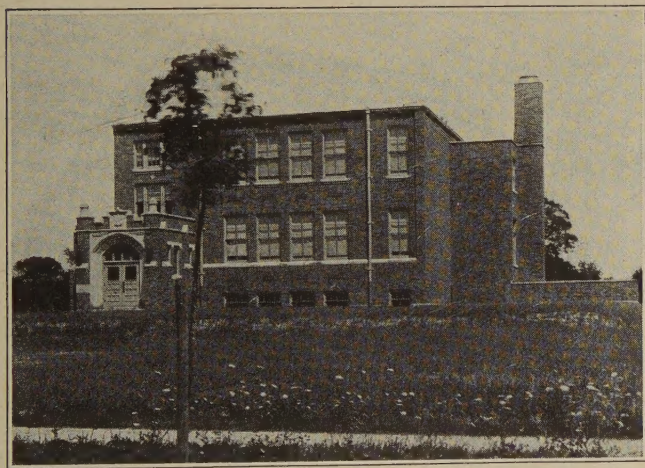


Figure 1. Bethlehem Evangelical Church building
This structure required 18,000 back-up units and 15,000 concrete brick

of increasing the scope of our market by putting concrete back-up and partition units in buildings such as hotels, office buildings, school and church buildings, hospitals, mercantile buildings, and so on. Buildings of this kind were going up every year, for our market includes a city of 115,000 population and a number of surrounding towns with populations ranging from 5,000 to 15,000.

In making a bid for this market we decided at once that we must win on quality rather than price. We manufacture haydite building units, and roofing tile of similar material. With this manufactured aggregate to start with we could not hope to compete with clay tile on a price

basis, even were we inclined to do so. Nevertheless, it would be necessary to hold down our unit production costs, and this meant that production in large quantity would be necessary.

Since large production volume was to be our aim and quality was to be our principal sales argument, manufacturing plant must be arranged and equipped with these purposes in view. This meant a plant layout that would facilitate the receipt and handling of aggregates and finished product, the selection of modern block-making machinery having a large production capacity, and the installation of material-handling equipment.

The plant is located about 3 miles from the downtown section of the city, with paved roads and streets leading to all markets. Railway service is supplied by a siding from the Nickel Plate tracks. This railway also supplies us with direct service from commercial sand and gravel pits some 40 miles away.

Figure 2 is from a photograph that supplies a good view

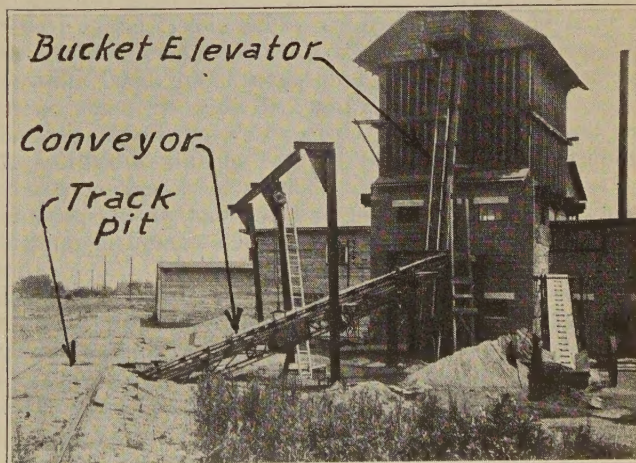


Figure 2. Track pit, conveyor and bucket elevator for receipt and storage of aggregates

of the facilities for receiving and handling aggregates, including the light-weight manufactured aggregates as well as sand and gravel. These materials are received in hopper cars, which dump the aggregates into a pit beneath

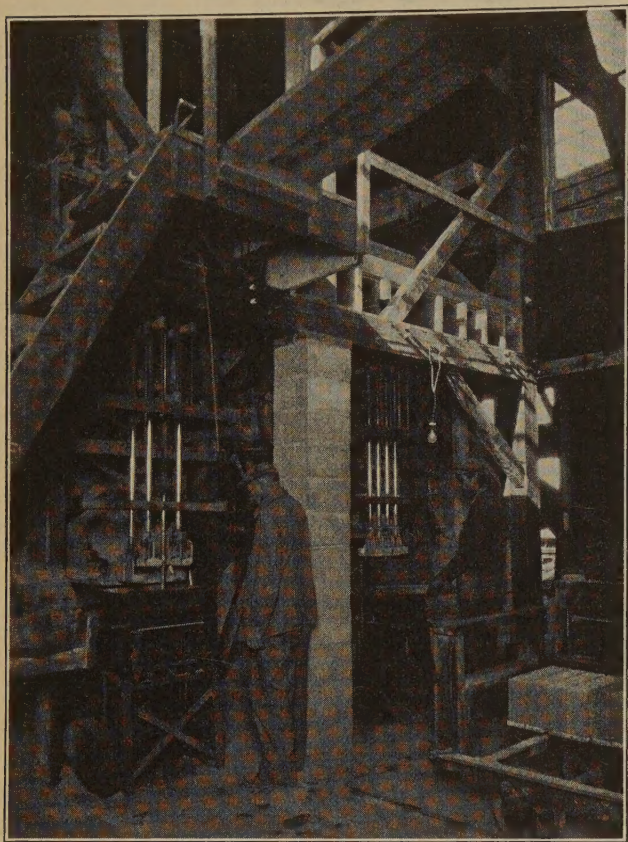


Figure 3. Interior view of the Acker products plant, showing block-making machinery

the railway siding. From the pit the aggregates are conveyed on the belt conveyor shown, to the vertical bucket elevator next to the building. The bucket elevator in turn conveys the material to a bin in the upper part of the building. The bin has three compartments, each with a capacity of 50 cu. yd. From these compartments the aggregates are fed by gravity into measuring boxes, and from these to the mixer, which is installed on the second floor. The mixer serves each of the block-making machines.

The most essential unit in our block-making equipment is an Anchor Junior stripper with tamper, power feeder and power strike-off. This machine is automatic in its operation, and it has a daily capacity of 2,500 units of standard size. A large variety of sizes are made on it, but the necessary mold changes are quickly made and production is economical because of this versatility of the machine. Recently we added a brick-making attachment to this same machine, and find that we can produce brick economically and with much less capital investment than with an independent machine.

A second piece of equipment is a Hobbs down-face machine under an Anchor floor tamper, its daily capacity being 500 faced units of standard size. A third machine, equipped for making light-weight concrete roof slabs, is an Anchor tamper over a stripper for making two slabs at one operation.

The freshly made units are placed on cars and are transferred to the curing kilns, where they are held under steam curing for a minimum period of 12 hours. The plant is provided with three curing kilns, two of which

contain four tracks each and one contains five tracks. Each track has a capacity of four cars. Following the usual practice, the loaded cars are then pushed from the kilns and shifted on a transfer track to the main yard track, where the units are stored. An excellent view of the storage yard is shown in Figure 4. This yard is always kept in a neat condition, not only as a matter of good housekeeping, but good business as well. Its appearance creates confidence in the quality of the product, in the minds of architects and others who may visit the plant to inspect the manufacturing process.

Sprinkling System for Storage Yard

A sprinkling system, designed to insure further curing in the storage yard, has been provided. The sprinkling arrangement consists of a 1-inch pipe about 8 ft. from the ground, alongside the track in the storage yard. Sprinkler heads at each storage pile spray water over the units. This system has been found valuable in dry, hot weather.

Provision Against Cold Weather

For some time we have heated the aggregates in the storage bins during cold weather by means of hot water and steam coils that are run up to the bins from small boilers provided especially for the purpose. A new heating system is now being installed which will utilize live steam from the main heating plant.

Roofing Slabs and Cast Stone

In addition to the regular building units which comprise the bulk of our output, we make light-weight con-

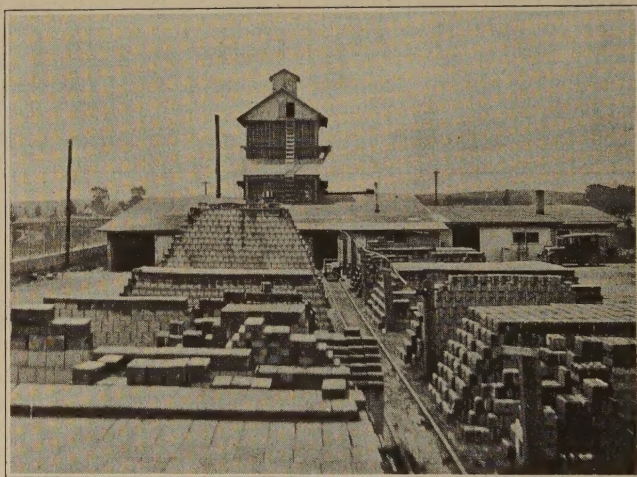


Figure 4. A neat storage yard helps sell the product
The main yard track and sprinkling line are shown

crete roofing slabs for which we have found a fair market, and we have developed a considerable demand for cast stone. Both of these products bring in additional business, and the competition in them is not so keen as with the regular building units.

Employees and Delivery

The plant is operated normally with a force of four men, consisting of one man at the mixer, one machine man and off-bearer, one all-round man and one on truck delivery. One girl takes care of the office work. The delivery equipment consists of three 1-ton motor trucks.

Sales and Promotion

At the time this plant was built in 1923, concrete masonry units were seldom used aside from dwellings and minor buildings. Our marketing plans and our manufacturing capacity, as previously stated, contemplated the

development of a demand for concrete units in buildings of the highest type.

The writer was charged with the duty of developing this market. It was a slow process, sometimes discouraging. Calls were made on architects, on school board members, on building committee members, and, in general, on owners and owners' representatives of all important buildings whenever information was obtained to the effect that important buildings were contemplated.

These calls met with little success at first. Architects had not specified hollow concrete units for important buildings, and for the most part they were lukewarm to



Figure 5. Lincoln Tower, Fort Wayne

This 22-story office building utilized 100,000 back-up units and 5,000 sq. ft. of precast concrete roof slabs

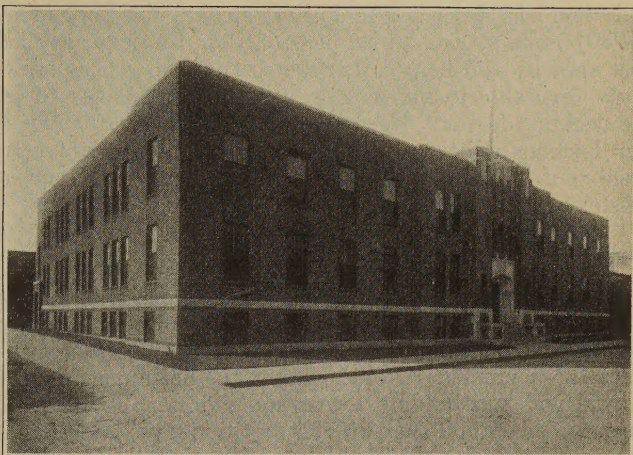


Figure 6. Seventeen thousand back-up units went into the Dudlo Manufacturing Co. office building

the idea. Owners were inclined to leave such matters to the decision of the architects.

Gradually the attitude changed. Samples left at the offices of architects made their impressions. Still more impressive was the occasional magazine article telling of the use of concrete as back-up and partition units in large buildings in the East and South. These facts were brought

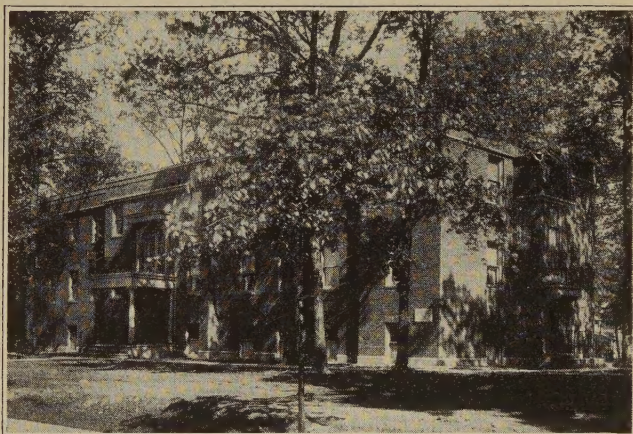


Figure 7. Bible Training School building. Sixty-seven hundred units went into this building as back-up

to the attention of both architects and owners. Then came the Underwriters' Laboratories tests, which demonstrated the fire-resistive value of concrete units. Next was the action of the Department of Commerce Building Code Committee in giving recognition to these units as a major masonry material. All these things helped, but a final favorable decision was not usually obtained until after the architect had visited the plant. Here is where the high-grade plant equipment and the consequent clean-cut appearance of the product, coupled with the neat and orderly appearance of the storage yard, often won the final victory.

Making Tests to Convince the Architect

In one instance an architect who had never before specified hollow concrete units for an important building, but who had seen them specified by other architects, requested a test which involved a comparison between the quantity of water absorbed by our haydite back-up units and by hollow clay tile. The method of conducting the test was devised in co-operation with the architect, and the test conditions approached closely to actual service conditions.

This test was described and illustrated in the September (1930) issue of CONCRETE, pages 21-23. Consequently all that need be said here is that the comparison was so strikingly favorable to the haydite units that it proved to be the deciding factor. The result was the use of 100,000 of our back-up units and 5,000 sq. ft. of light-weight concrete roof slabs in the Lincoln Tower in Fort Wayne, a 22-story office building.

Units Sold in Large Quantities

While the Lincoln Tower requirements of 100,000 units constituted our largest single order to the present date, we have supplied back-up and partition units in large quantities for a number of other important buildings in Fort Wayne and surrounding towns and cities. For instance, we supplied 15,000 back-up and partition units and 18,000 concrete brick for the Bethlehem Evangelical Church in Fort Wayne. An office building for the Dudlo Manufacturing Co. utilized 17,000 back-up units. A school building in Bourbon, Indiana, required 20,000 back-up units. The Steinite Radio Company building in Fort Wayne used 15,000 back-up units. A building for a type-setting and engraving plant required 8,000 back-up units and a number of cast stone lintels. The Bible Training School building used 6,700 back-up units. A building for the Kroger Stores required 2,500 back-up units. A gymnasium addition to a school in Laketon, Indiana, required 4,000 back-up units. The new Methodist Church building at Roanoke, Indiana, required 3,000 back-up units. A store building addition for Stanley & O'Conner, in Fort Wayne, required 2,720 units and some cast stone lintels. The Keefer Printing Company building used 2,000 back-up units. We supplied 4,630 back-up units for a residence for C. L. Maish, in Warsaw, Indiana, and 4,600 units for the Perfect Warehouse Company building in Fort Wayne. St. Paul's M. E. Church, now under construction in Fort Wayne, will require a number as yet undetermined.

Summarizing the list of buildings just named, we have sold 223,000 back-up and partitions, and some cast stone and roof slabs, on 14 buildings of types for which concrete masonry units would not have received serious consideration ten years ago. These sales have been made on quality alone, for in all cases clay tile could have been obtained and placed for less money.

Fowler Award Competition to Close January 16th

Designers of Concrete Bridges of Outstanding Architectural Merit Invited to Enter Competition—Photographs and Other Data Required

January 16, 1931, has been set as the closing date for receiving material in the competition for the 1931 Phebe Hobson Fowler Architectural Award.

Photographs and other data pertaining to structures entered in the competition should be mailed to the American Society of Civil Engineers, 33 West 39th Street, New York, accompanied by a letter stating that the material is being submitted for the consideration of the Fowler Architectural Award Committee.

The award shall preferably be made for the design of a bridge having outstanding architectural merit. Only completed work will be considered.

Members of any grade of the American Society of Civil Engineers are to be considered first as to eligibility for the prizes. Awards may be made to members of the other three national engineering societies of mining, mechanical and electrical engineering in any grade, provided no work

of sufficient merit has been submitted by the membership of the American Society of Civil Engineers.

A liberal number of photographs not smaller than 8 by 10 inches in size, accompanied by a brief description and history of the structure, constitutes the best form of presentation. At least one photograph should be a broad-side view. It is considered entirely proper for bridge designers who have outstanding work to their credit to initiate the submission of material for the consideration of the committee.

The Fowler Award consists of three prizes. The first prize is a gold bronze medallion, the second is a silver medallion, and the third is an honorable mention and certificate.

The first and third prizes in the 1930 competition were awarded to designers of concrete bridges, both of which were of the open spandrel multiple-arch type. These two structures were mentioned and illustrated in the September (1930) issue of CONCRETE, page 16.

Residential Building Continues Improvement

Public Works and Public Utilities Also Holding Up Well—Concrete Pavement Awards Falling Off

Construction of residential buildings is continuing at a good pace, the value of contracts awarded for buildings of this occupancy having been greater in October than in any other month since May of this year, according to reports issued by the F. W. Dodge Corporation, covering the 37 states east of the Rocky Mountains. In contrast, contracts for commercial buildings fell below the figures for September, so that the total of new building contracts was slightly under the previous month.

Contracts for new construction for public works and public utilities made an excellent showing in October, the figure standing not only above the previous month, but well above October, 1929. The totals reported by the Dodge organization are:

CONSTRUCTION CONTRACTS IN OCTOBER

	1929	1930
Buildings	\$360,525,900	\$226,105,500
Public works and public utilities	85,116,400	111,195,900
Totals	\$445,642,300	\$337,301,400

Total contracts awarded in the first ten months of the year amounted to \$4,022,024,900 in 1930, and \$5,046,909,900 in 1929.

October was the third month this year in which concrete highway pavement awards were below the figures for the corresponding month of 1929. Concrete street and alley pavements continued well below last year, so that the net result of the month's pavement awards cut into the lead that 1930 has maintained over 1929. The pavement contracts reported by the Portland Cement Association are:

SQ. YD. OF CONCRETE PAVEMENT AWARDED IN OCTOBER

	1929	1930
Roads	9,157,203	6,820,000
Streets	3,676,684	2,750,053
Alleys	317,518	175,361
Total	13,151,405	9,745,414

For the first ten months of the year, the total contracts awarded for concrete pavements amounted to 130,719,136 sq. yd., compared with 126,843,894 sq. yd. in the first ten months of 1929.

Five Scattered Hospital Buildings Concreted from One Plant

New Concrete Buildings Added to Veterans' Hospital No. 1 at Northport, Long Island—Successful Distribution of Concrete with Long Chutes—Make and Repair Forms in Well-Equipped Carpenter Shop—Build Incline for Direct Delivery of Aggregates

THE construction work on six new reinforced concrete buildings at United States Veterans' Hospital No. 1, at Northport, Long Island, N. Y., includes several features that are of interest in cases where the various units of a scattered group of buildings of similar type are under construction at the same time. Among these features are the well-equipped shop for making up and repairing forms, the concrete mixing and distribution plant, and the construction of a fill to permit delivery of sand and gravel directly into the bins above the mixer.

The six buildings, which represent a total contract of about \$1,000,000, are of the same general type, containing two stories and a basement, with wall columns, interior columns, girders and floor construction of reinforced concrete. Above the concrete ceiling slab of the second story will be a sloping roof of wooden construction and covered with slate, this feature being included to conform to the architecture of older buildings at the hospital. Exterior panel walls are of brick facing and tile back-up, and interior partitions are of tile construction, and the plaster will be applied directly to the tile. Column footings are the spread reinforced concrete type.

The six buildings in the group now under construction include an occupational therapy building, an attendants' quarters, an acute treatment building, an infirmary building, a continued treatment building, and an officers' duplex quarters. All buildings combined will utilize about 8,000 cu. yd. of concrete.



Figure 1. A well-equipped carpenter shop supplies all form work

Carpenter Shop for Making Up Forms

Because of the large number of columns of the same length and size, or nearly so, and the floor panels of similar size, it was recognized at once that a great part of

the form work could be made up in form units and used a number of times.

The form work carpenter shop was accordingly built as shown in Figure 1. It is 19 by 45 ft. in plan, equipped with two gasoline-driven job saws and three lines of

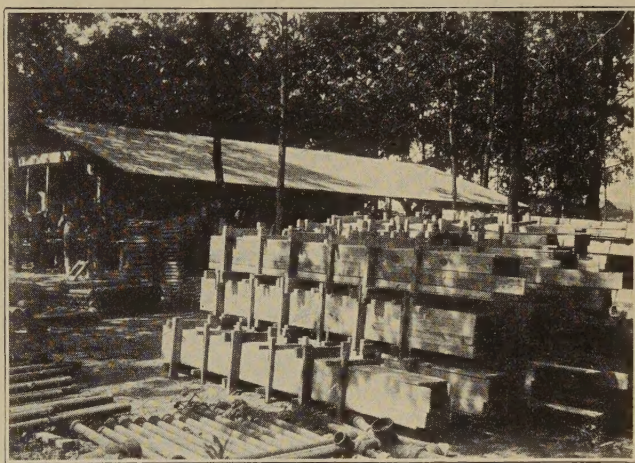


Figure 2. Made-up column forms stored in the make-up yard

make-up benches, and manned by an average force of ten men. This force is kept busy making up new form units and repairing used form units for re-use. A view of the form make-up yard, with made-up column forms in the foreground, may be seen in Figure 2.

Concrete Mixing and Distributing Plant

The concrete for five of the six buildings is mixed at a centrally located plant equipped with Blaw-Knox batchers, a water measuring device, and a 10-S Rex mixer. The location of the concrete mixing plant is directly between two of the larger buildings. For these two buildings the concrete is distributed by buggies, direct from a hopper alongside the main hoist tower, and just above the mixing plant. The concrete for these two buildings is therefore hoisted only about 30 feet. This involves nothing out of the ordinary, the buggies being operated over the usual runways built for such a purpose.

Delivering concrete to the buildings farther away, however, was a problem that required a different solution. The method selected was that of the hoisting tower and long chute. For a long time this method has been in more or less disfavor because of the danger of segregation of aggregates and the tendency to make the slope of the chutes too flat and the mixture too wet.

Fortunately, the superintendent of construction, L. E. Palmer, knew from previous experience that concrete

could be delivered by means of a hoisting tower and long chutes if the consistency of the mixture were just right and the slope of the chute were sufficiently steep. Accordingly, he built the chute at a slope of about 35 degrees with the horizontal. At the mixing plant he had maintained a

to the sack of cement. For the concrete in roadways and for plain concrete work the proportions are 1:2½:5 with 7½ gallons of water to the sack of cement. As previously stated, the quantity of the admixture is a gallon of the powder to each two sacks of cement.

Delivering Aggregates Into Overhead Bins

A unique feature of this project is the manner in which provision was made for delivering sand and gravel directly into the bins above the mixer, from which the materials are dropped by gravity into the measuring boxes that charge the mixer.

The manner in which this was accomplished may be seen in Figure 5, showing the side and rear of the concrete mixing plant and a part of the hoisting tower. The mixing plant was set as low as practicable, after which the incline shown in Figure 5 was built with excavated material. Trucks hauling sand and gravel ran up the incline and dumped directly into the bins through the open side near the top of the mixing plant. This feature was made possible because the excavated material consists of a fine sand, easily removed, and mixed with enough clay to cause it to pack well. After the construction of the buildings is

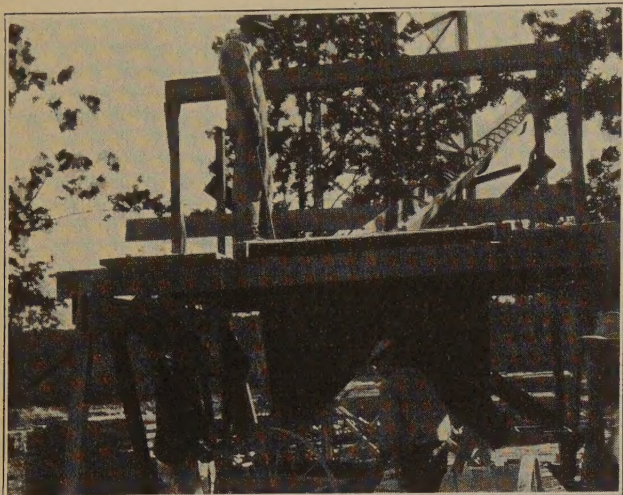


Figure 3. At the discharge end of the long chute buggies make the final distribution

plastic consistency that is aided by the addition of a siliceous admixture, a gallon of the yellowish powder being added to each 2-sack batch of concrete. Actual mixing is continued for about 1 minute and 10 seconds. The result is a mixture of slushy consistency having much similarity to that obtained in other instances which the writer has seen, where sand and gravel were used as aggregates and diatomaceous earth or similar siliceous material was used as an admixture. The concrete in this instance has the same appearance when it emerges from the far end of the chute as it has when discharged from the mixer. The admixture employed in this concrete is produced by the American Tripoli Company, of St. Louis.

The chute discharges into the two-way hopper shown in Figure 3 and is distributed by buggies from that point.

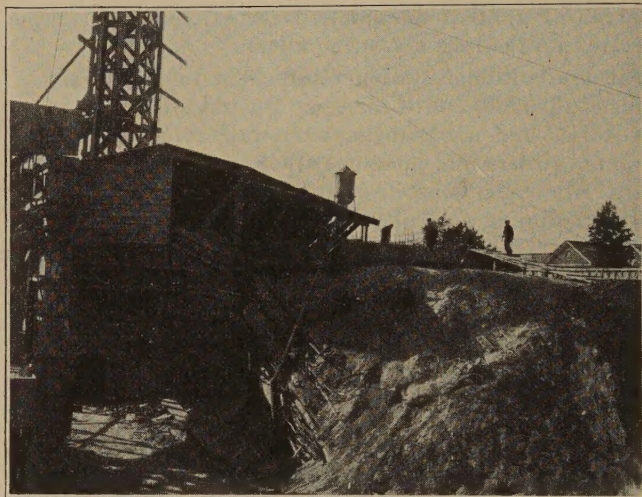


Figure 5. Incline built with excavated material permits trucks to deliver aggregates into overhead bins

completed the material in the incline will be used in the grading of the grounds.

Acknowledgments

The general contractor on this work is the Virginia Engineering Company, Inc., of Newport News, Va. L. E. Palmer, the superintendent of construction in charge, has had charge of more than 50 million dollars' worth of construction work for the United States government and various state, county, and municipal governments throughout the East and South. His last work before coming to the Veterans' hospital at Northport was the construction of an \$850,000 medical and surgical building at St. Elizabeth's Hospital, Washington, D. C., for the Interior Department. The contract for that building, which is also under the jurisdiction of the United States Veterans' Bureau, was held by the W. P. Rose Company, of Goldsboro, N. C.

Paris Transit Mixed Concrete Makers to Meet

The National Association of Paris Transit Mixed Concrete Manufacturers is planning to hold its convention at St. Louis, Mo., on January 9th to 12th.

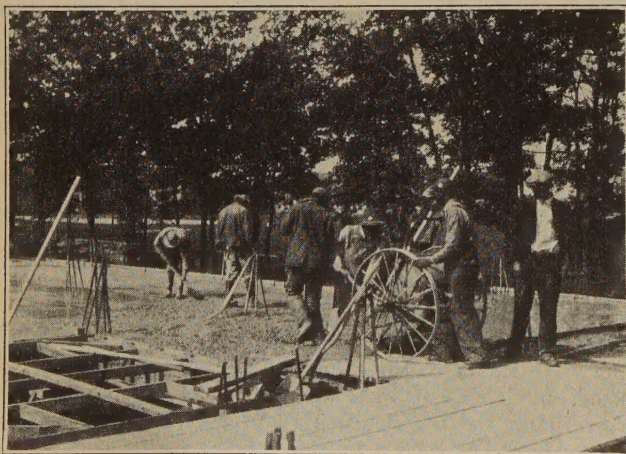


Figure 4. Placing the second floor concrete in one of the buildings

The final depositing of this chuted concrete, on the second floor of one of the buildings, may be seen in Figure 4.

Proportions of Concrete Mixtures

The proportions specified and used for the concrete for columns and column footings and for the floor slabs, beams and girders, were 1:2:4 with 6½ gallons of water

Seattle's Concrete Pavements Cured with Continuous Sprinkler

City Specifications Require Continuous Curing for Ten Days—Either Sprinkling or Ponding Permitted, but Former is More Economical—Sprinkler Head Designed Especially for Paving Work—Cost Data

By H. F. FAULKNER

Assistant Engineer, City Engineering Department, Seattle, Wash.

FROM a compilation of the results of many tests throughout the United States, as well as our own tests and observations, it is conclusively proved that one of the most essential requirements for good concrete pave-

ment is prompt, proper and adequate curing, so that the concrete may be strong and hard when the pavement is opened to traffic and in fit condition to withstand the influences which tend to destroy it.

On flat grades the contractor may, at his option, cure the pavement by constructing earth dams across it and along its edges, and maintaining a depth of not less than

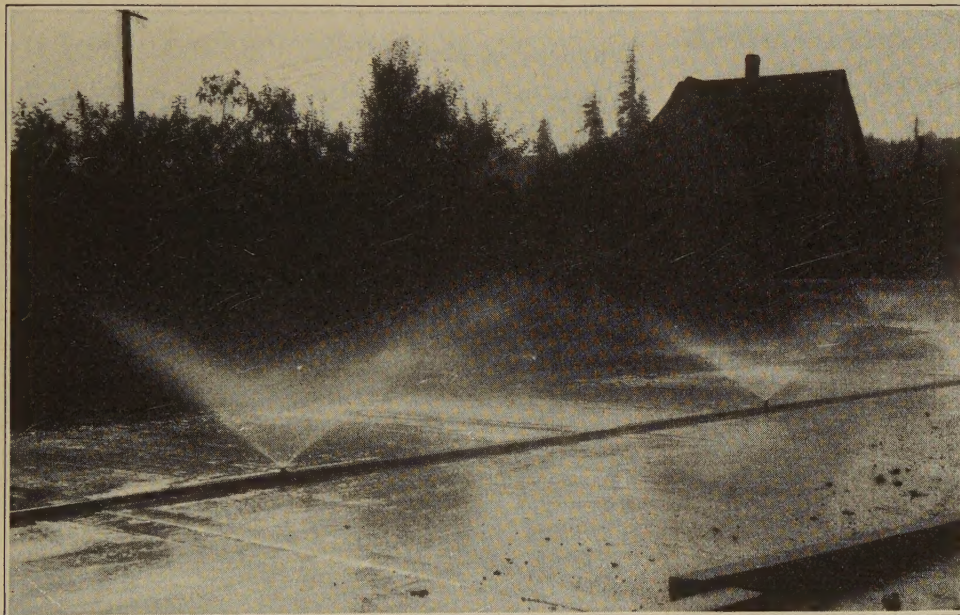


Figure 1. Sprinkling system in operation on city streets

ment is prompt, proper and adequate curing, so that the concrete may be strong and hard when the pavement is opened to traffic and in fit condition to withstand the influences which tend to destroy it.

Many methods of curing have been tried, but I am convinced that no better method has been found than a constant application of water to the surface of the slab. This not only prevents loss of moisture from the concrete by evaporation, but also supplies sufficient moisture so that the demands of the subgrade will not draw water from the concrete faster than it may be renewed by absorption of the surface water into the concrete.

Our specifications require that, as soon as the pavement can be sprinkled without injury to the fresh concrete, it shall be covered with burlap sheets two feet wider than the pavement, and that the contractor shall supply sufficient burlap to cover an entire day's run, allowing a two-foot lap for each sheet. This covering must be kept continuously wet and maintained in place until a system of continuous sprinklers is installed the following morning. The sprinklers shall be operated day and night with-

two inches of water over the entire surface of the pavement for ten days. While this method of ponding is permitted, it is seldom used, as it is generally much easier



Figure 2. Sprinklers in use in downtown section of Seattle

and cheaper for the contractor to cure the pavement by sprinkling.

Our present system was developed here several years ago. At first we used ordinary whirling lawn sprinklers, which used many times the amount of water necessary and distributed it over a considerable area of the surroundings, as well as the pavement. These objections have been overcome through gradual improvement toward the present perfected sprinkler head, which throws a very fine

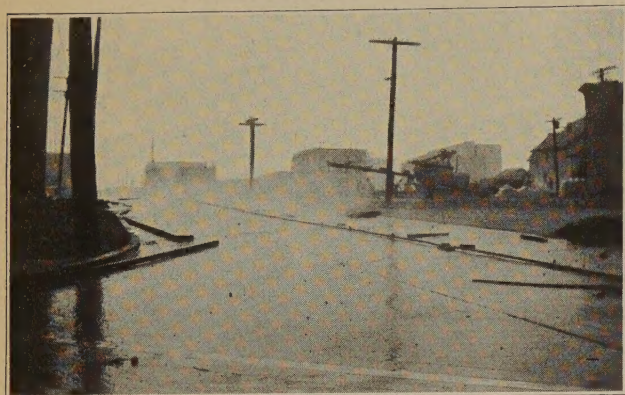


Figure 3. The system keeps pavement in thoroughly wet condition

spray or mist, and which when screwed into tees on a $1\frac{1}{4}$ -inch pipeline at intervals approximately 20 feet apart will continuously water the surface of a pavement 25 feet wide. Pavements wider than this are usually constructed in two operations.

Automatic Valve Control Saves Water

Our specifications also permit the use of an automatic, intermittent valve control in the hydrant lead supplying the line of sprinklers. This device may be adjusted to give such on and off periods of sprinkling as may be required to keep the pavement wet. Where this control has been used it has effected a saving of some 75 per cent in the amount of water used. The sprinkling system is

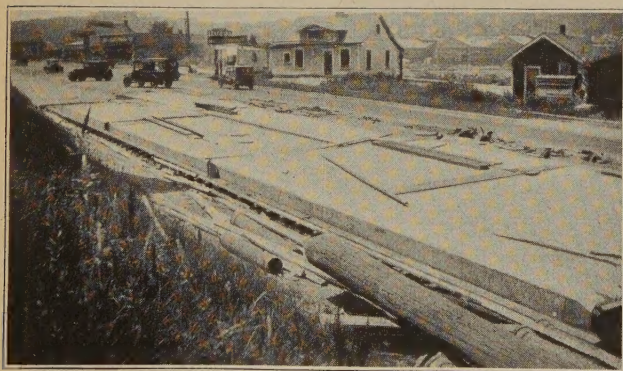


Figure 4. Similar sprinkling system employed in curing concrete piles in storage yard

specially adapted to the curing of city pavements where connections may be made with hydrants at frequent intervals and where the pressure is sufficient to create a satisfactory spray through the sprinkler heads.

Some of the practical points involved in the use of these sprinklers will be of interest to paving contractors. There is, for instance, the problem encountered with a stiff breeze or strong wind. To overcome its effect the line of sprinkler heads is tipped toward the wind, but

it is necessary to keep making adjustments as the force of the wind increases or abates.

Making Hydrant Connection

A very important consideration is that of taking full advantage of gravity in making the hydrant connection with the distributing pipeline, when the pavement is on a slope. Not infrequently contractors make this connection at the low point, when it could just as well be made at the high point, where for obvious reasons it should be.

The matter of pipe sizes is also important. Some contractors use a 1-inch distributing pipeline, although by using a $1\frac{1}{2}$ -inch pipe they could cover twice as much distance.

In taking up or resetting the pipelines it is not necessary to remove the sprinkler heads and no unusual care is necessary in handling them.

The Seattle city water department charges a flat rate of three cents a square yard for water used for curing concrete pavements and the cost of placing and removing the sprinkler line is approximately two cents a square yard, making a total cost for curing of about five cents a square yard.

Simplicity of Method

When the curing period is over there is nothing to do but to pick up the line of sprinklers, leaving a clean surface, with no objectionable dust or mud to be removed and no borrow pits for earth cover in parking strips or roadway to be filled and dressed. We have reason to know that this method of curing avoids controversy with both contractors and property owners, and it results in a workmanlike job and a neat clean pavement when it is opened for public use.

Figure 1 is a close-up view of the sprinkling system in operation. Figure 2 shows a similar system in operation in the downtown section of Seattle even before the pavement was cleared of construction material. Figure 3 is an excellent illustration of the thoroughly wet condition in which the pavement is kept. Figure 4, entirely aside from the question of pavements, shows a similar sprinkling system employed in curing concrete piles in a storage yard.

Narrow Pavements Prove Economical in Their Logical Place

By E. E. DUFFY

Narrow concrete pavements, 9 or 10 feet wide, are proving economical in rural communities where funds and resources are somewhat limited. Delaware, one of many states that are building considerable mileages of these paved local roads, has found that all upkeep costs annually average about \$100 a mile, which includes upkeep of surface, ditches, and shoulders.

While the narrow pavement may appear to be inadequate for modern traffic, the fact that there is little through traffic on these roads and that they are designed to give year-round contact with arterial highways and markets makes them useful.

In this connection Chief Engineer W. W. Mack, of Delaware, relates that in 1929 a delegation appeared before the highway commission protesting against the award of a single track concrete job. The commission awarded the contract, and the following year the same delegation was so pleased with results that it again appeared before the commission, urging the extension of this type of construction.

Ready-Mixed Concrete

sold on strength basis

at Low Unit Cost

Plant of Central Concrete Mixing Corp., in Brooklyn,
Designed for Large Production—Cement and Aggregate
Handled with Mechanical Equipment—Independent In-
spection Service as Guarantee of Quality—Concrete De-
livered in Agitator Bodies

THE ready-mixed concrete plant of the Central Concrete Mixing Corporation, at Court and Percival streets, in Brooklyn, N. Y., is well equipped to supply concrete of predetermined strength on a large quantity basis. This plant, which started operations in March, 1930, is the first of several contemplated by this company, the

bins is equipped with a mechanism that rings a gong at the unloading dock when the bin is full.

Cement and Aggregate Storage Facilities

The three main storage bins for cement consist of three circular steel bins, each 22 ft. in diameter and having a capacity of 1,500 bbls. The bins are equipped with watertight steel covers, and with ladders, vents and manholes.

From the main storage bins the cement discharges into a series of screw conveyors which convey the cement horizontally to the receiving hopper of a vertical bucket elevator shown most clearly in the center of Figure 1. This elevator, in turn, elevates the cement to a 600-barrel two-

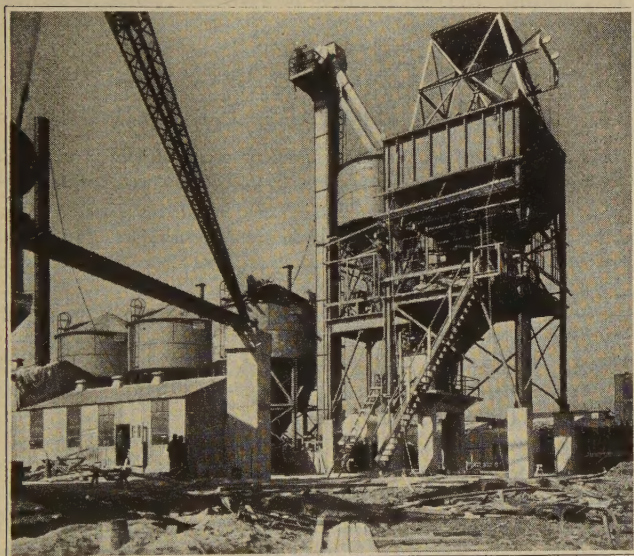


Figure 1. General view of Central Concrete Mixing Corporation's ready-mixed concrete plant

second having lately been completed at Varick and Meserole streets, in the same city.

From the receipt of cement to the delivery of mixed concrete the company depends on mechanical equipment as a means of attaining the goal of large production at low unit costs.

Cement Received in Bulk

Cement is received in bulk, from a barge owned by the Hercules Cement Corporation and known as a car float. That is, the barge transports the bulk cement railway freight cars belonging to the same cement company, and from these cars it is pumped by a 5-inch Fuller-Kinyon installation to the three main storage bins. These bins may clearly be seen at the left center of the general view of the plant, shown in Figure 1.

The pump delivers cement at the rate of 250 bbl. per hour in short periods, and over long periods it has delivered as much as 3,600 bbl. in 18 hours. Each of the

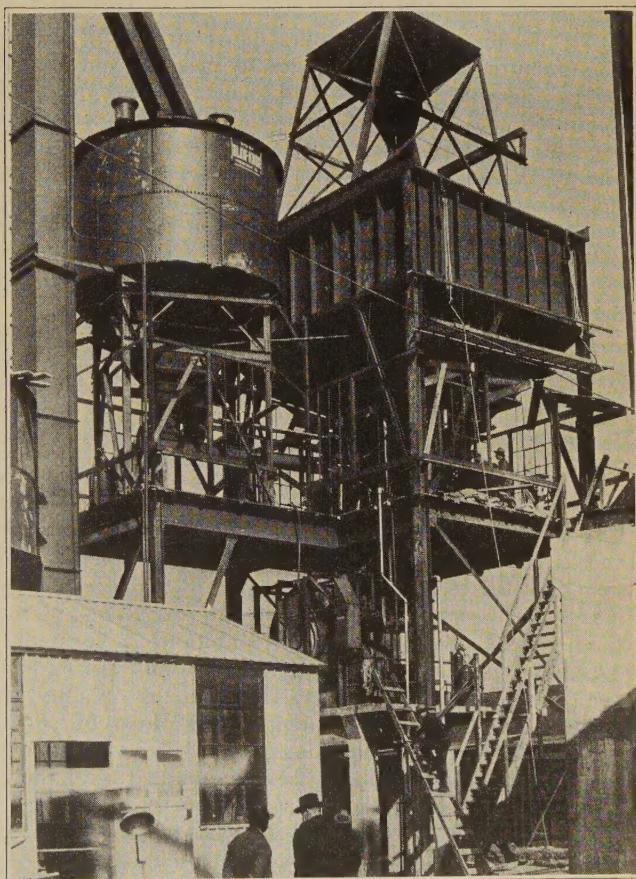


Figure 2. Close view of mixing plant. Two-compartment cement service bin and aggregate bin above

compartment service bin located near the mixer. This service bin, also clearly shown in the illustrations, is 15 ft. in diameter and is divided into two compartments so as to permit the use of both special and standard cement.

The 600-bbl. service bin is fitted with two discharge gates which feed into a screw conveyor, which in turn discharges into a cement weighing batcher mounted on the central mixing plant. The total storage for cement is 5,100 bbl.

The aggregate bin is the rectangular bin above the mixer. It is self-cleaning, like the cement bins, and is of 300 tons capacity. It is filled by means of a stiff-leg derrick, from barges which deliver the material near the plant. A 10 by 10 ft. hopper surmounts the aggregate bin and the clamshell bucket discharges into it, the hopper being fitted with a spout and mounted on a turntable so that it can discharge into any one of the four bin compartments. Operating platforms for the two-compartment cement bin and for the aggregate bin are included in the structural supports for the bins. The mixer is supported independently of the bin supports so as not to transmit vibration to the measuring equipment, thus reducing the wear and preventing inaccuracies of proportioning.

Proportioning and Mixing Equipment

The proportioning equipment for the control of concrete, which is attached to the aggregate bin, includes one quadruple 16,000-lb. weighing batcher for measurement of fine and coarse aggregates. This unit includes four radial gates for the bin and a four-beam scale of the multiple type, one beam for each aggregate. Another attachment is a 3,000-lb. weighing batcher for cement. A third important attachment is a 250-gal. water-cement ratio measuring tank with compensating connection for moisture in the aggregate.

All of these proportioning units are of Blaw-Knox manufacture and are adequate to measure out the necessary ingredients for a 3-yd. batch. The controls for operation and the weighing scales are so arranged that one man can measure out cement, water, both aggregates, and discharge the materials into the mixer and operate the mixer from the operating platform. The mixer is timed for 1½-minute intervals between batches. The time required for discharge and taking in a new batch of materials is 15 seconds, leaving 1 minute and 15 seconds as the actual mixing time.

The delivery trucks are of 5 cu. yd. capacity, so that a truck taking on a full load will receive first a 3-yd., then a 2-yd. batch.

Independent Testing Laboratory Service

As a guarantee of quality concrete, all concrete mixed at the plant is under the supervision of E. L. Conwell & Co., of Philadelphia. Their representative at the plant checks up on the control of the strength of concrete, takes cylinders for making the 7-day and 28-day strength tests, makes the necessary changes due to variations in moisture content, and, in general, maintains a constant inspection. He has a number of items of field testing equipment installed on the mixing floor. He is on duty from 7:00 A. M. to the time when the last load of concrete leaves the plant in the evening.

Excellent relations have been maintained with the city building inspection department, and city inspectors assigned to construction work serviced by the plant have invariably co-operated with the plant manager.

Concrete on Guaranteed Strength Basis

As a general practice, concrete is sold to the user on a guaranteed strength basis, although the proportions for

the strengths most commonly supplied are 1:2:4, 1:2½:5 and 1:3:6.

Delivery Equipment

Frequently the plant supplies from 700 to 800 cu. yd. of concrete in a day of 9 hours. This volume of production is made possible by the large capacity of the mixer—3 cu. yd.—and the large capacity of the agitator truck bodies, all of which carry either 3 or 5 cu. yd. The company owns 45 trucks, all having Sterling chassis and either Blaw-Knox or Jaeger agitator bodies.

Heating Aggregates in Winter

During cold weather the concrete aggregates are heated in the storage bins, which are lined with heaters of cylinder form. Steam is forced through these cylinders by a heating system that operates under a pressure of 25 to 30 lb.

The Plant Force

The plant is operated with a force of eight men, including a mixer man, a plant mechanic, a hoisting engineer, a shipper, a boat trimmer and three yard laborers.

J. G. Mann is the plant superintendent and A. Thomas is resident inspector for E. L. Conwell & Co. The general manager of the Central Concrete Mixing Corporation is A. Johnson, and M. Golden is assistant general manager.

Cement and Concrete Well Featured at London Building Exposition

Elaborate Displays by Cement Companies Emphasize Strength, Artistic Possibilities and Utility of Concrete—Special Cements and Special Products Shown

By A. C. BLACKALL

London's biennial Building Exposition, which has just concluded a very successful two weeks' run, had more stands devoted to the display of cement, concrete, and concrete products than any previous building exposition staged in the United Kingdom.

The great strength, artistic possibilities and utility of concrete were excellently featured by the exhibits of the Cement Marketing Co., which is the selling organization of the Associated Portland Cement Manufacturers, Ltd. Here were to be seen a reinforced concrete pile, which though driven when only eight days old, had a perfect head, and some attractive examples of fountains, figures and sculptural work together with roofing tiles, fireplaces, and window frames. An interesting exhibit was an apparatus for determining the quantity of "flour" present in cement.

Demonstrations of the various methods of obtaining artistic surface finishing from white and colored cements were given at the stand of the British Portland Cement Association, Ltd., where various types of concrete building units, such as bricks, tiles and examples of cast stone, were also to be seen.

At the stand of the Lafarge Aluminous Cement Co., Ltd., details of the important works which have been carried out with ciment fondu during the past six or seven years and all necessary technical explanations were obtainable, while a gallery of very interesting photographs was on view.

Other interesting stands included those of Caxton Floors, Ltd., illustrating the construction of hollow-tile concrete floors, and the Helical Bar Engineering Co., which featured examples of artificial stone made in a hydraulic press under a pressure of 500 tons.

Twelve-Month Construction Year Profits Everyone

Advantages Outweigh Disadvantages—Severity of Winter Weather Overdrawn—Procedure for Concreting in Cold Weather—Construction Fire Hazard Increased—Avoid Applying Heat Too Rapidly—Additional Cost of Winter Work

THERE has been substantially increased winter construction during the past ten years as compared with the prewar period. Scattered experience with winter construction before the war was greatly multiplied as a result of wartime undertakings, and the industry and the public became much more familiar with the idea.

Twelve-month construction of many types has a sound economic basis. On large projects occupying more than eight or ten months it is obviously in the interest of the owner that there should not be a winter shutdown, and even on shorter jobs there are often advantages in having much of the work carried on during the winter.

Every Construction Group Will Gain

Practically every group connected with construction—engineers, architects, contractors, building material manufacturers and dealers, transportation agencies, and building trades labor—all stand to gain through steadier operations throughout the year. The larger organizations, and greater investments in plant and equipment now required for building operations tend to increase carrying charges during dull periods and thus make stabilization of greater importance to engineering and contracting organizations. The problem affects so large a section of the community as to be of importance to many other lines of business and the public generally.

Statement of the Problem

The problem appears to be twofold. On the one hand, building owners, public works officials and others responsible for starting construction or for having repairs and maintenance carried on, require education as to what can be accomplished by means of distributing construction more evenly throughout the year. Local efforts on the part of building congresses and other groups, the sales efforts of individual contractors and other business men, the advice of competent engineers, and various national efforts centering in the work of the Committee on Seasonal Operation in the Construction Industries, which was appointed by Mr. Hoover in 1923 and reported in 1924, have all been important factors. The seasonal operation committee concluded that "custom, not climate, is mainly responsible for seasonal idleness in the construction industries."

On the other hand, as pointed out in the committee's report, the construction industry has important responsibilities in advancing and applying the technique of twelve-month construction to various types of operations.

Cold weather and rainy seasons are the principal obstacles to be overcome, although lowered efficiency during extremely hot weather frequently is not taken into account

in making comparisons between winter and summer costs. The study prepared by the Division of Building and Housing for the committee includes a detailed analysis of weather conditions in nine representative construction centers, well distributed geographically.

It is the special task of the engineer carrying on construction, which is subject to interruption from weather conditions, to familiarize himself with methods and costs of more or less continuous operations, and in regard to probable delays that may be expected in spite of precautionary measures. While certain operations, such as the paving of roads while there is frost in the ground, are not now considered suitable for winter work, or during rainy seasons in some areas, there is still room for further development of improved methods of winter work in many fields.

The chief arguments against winter work are the extra cost of protection and reduced efficiency and production of labor and machinery. Of these the first is an actual cost, the other is in a measure, at least, controllable by the ingenuity of the engineer or contractor and by the employment of methods which experience has shown to be effective.

Severity of Winter Weather Overdrawn

As has been indicated, the picture of winter is inclined to be overdrawn. Severe weather comes in comparatively short spells with the balance of the season consisting of weather with moderate temperatures. Production on a clear, snappy winter day may not suffer in comparison with production on a hot, sultry day in August. With reasonable resourcefulness and initiative, working conditions can be made nearly as agreeable in winter as in summer, the problem in the summer being to keep the heat away, in the winter to supply the heat.

The requirements for winter work differ from those of summer chiefly in the additional requirements of heating, housing, and protection of work in place. Add to this difficulties of transportation in the case of the isolated project, and the process reduced to a routine nature becomes one of getting materials to the job, preparing them for use, protecting work in place while curing if necessary, and the housing of personnel and equipment incident to the work.

Procedure with Concreting Operations

The process employed in the case of concrete construction consists usually of heating the fine and coarse aggregates, heating the mixing water, or heating both in combination, the protection of stock piles for both masonry and concrete work, the housing of materials affected by moisture, and the housing of the entire mixer and plant.

The principal requirement for concrete work is that the

Abstract of paper by James S. Taylor, Chief, Division of Building and Housing, United States Bureau of Standards, read before the Construction Division of the American Society of Civil Engineers in St. Louis, October 2, 1930.

temperature of the concrete when placed shall be above 60 deg. F. and whether this is obtained by heating aggregate and water separately or in combination, or heating the water alone, is a matter for the individual. Any method is acceptable so long as the desired result is obtained.

The necessity for housing materials affected by moisture, the value of housing the mixer and plant when exposed to the weather, and the desirability of locating the mixer in the basement of a building operation, whenever possible, are obvious.

Having the materials prepared for use, the next step is to protect them from frost while placing and curing. This becomes of more importance in building operations than in bulk work such as bridge and dam construction. The relatively smaller section of a concrete beam or column is more readily and more seriously affected by freezing than the larger mass of a bridge abutment or a section of a dam, and in addition the bulk concrete provides more heat in setting and this heat is less easily dissipated from the larger mass.

In building construction it is not usually expedient to house in the entire building, although this has been done in a few cases. But it is entirely practicable to enclose with canvas the story being framed and possibly the story next below. Heat is then provided from devices of suitable nature, usually salamanders, and the concreting proceeds as at any other season. The required temperature, checked by thermometer readings, is maintained long enough to permit the concrete to secure its permanent set without harmful effects of frost action. The next story is treated in like manner and so on up the building. It is usually necessary to protect the slab after placing concrete and this is done by covering with canvas or straw, or both, and by leaving a few small openings in the slab permitting the heat from below to circulate over the top of the slab.

Fire Hazard Greater in Winter

In construction work during winter months certain precautions must be observed which are not of so much importance in summer work due to changed conditions. The heating of materials and work in place and the use of open fires introduce fire hazards which are absent during summer months, and the effect of cold weather on fire fighting facilities makes it more difficult to combat fires. For this reason constant vigilance must be maintained and watchmen and inspection services must be kept at a high standard.

Especial care has to be exercised in the stripping of forms and in reshoring because of the slower hardening of concrete. Frozen concrete must be removed when detected and snow and ice cleaned from the forms before concreting is started. Safe accessibility to working operations about the job must be provided, and this includes the removing of snow and ice from walks, stairs, and ladders and the sanding of walks, stairs and runways to prevent their becoming slippery and dangerous.

Temporary water and air lines cause considerable annoyance and delays in cold weather through freezing. Low spots in these lines must be avoided and the lines either packed in straw or buried below the frost line whenever possible. Draining the lines at night will usually insure a water supply being available for morning work.

The ill effect of too rapid an application of heat to work in place is another factor. Salamanders should be placed at a sufficient distance from fresh concrete to insure against too rapid or uneven drying and shrinkage of the concrete. The use of salamanders lowers the moisture content of the air and this must be replaced from other sources.

All these precautions necessarily cost money, but analysis indicates that the extra amount is not serious when brought into relationship with the advantages. Actual figures on the extra cost of providing protection and temporary heat for winter work are not as available as might be desired. From the data at hand it appears, however, that this extra cost ranges from 1 to 5 per cent of the total cost of the operation, decreasing as the size of the job increases. But considering the operation as a whole, and having in mind the interests of all concerned in the year-around program, this percentage of increase often is absorbed and disappears in the benefits resulting from release of tied-up capital, savings in labor cost from increased production and more efficient labor, closer bidding by contractors and an earlier use or occupancy of the completed structure. Twelve-month construction, all in all, has proved its soundness, and its right to united support.

Outline of Subjects to Be Covered at Highway Research Board Meeting

The meeting of the Highway Research Board, scheduled to be held at Washington, D. C., December 11th and 12th, will be devoted to the presentation and discussion of the results of research work in connection with the building and use of highways.

Some of the subjects to be covered in the committee reports are durability of aggregates, the effect of flat and elongated particles in aggregates, effect of dust coatings on aggregates, method for rectifying pavement settlement.

Reports on special investigations cover the curing of concrete pavements, and the use of rail steel for reinforcing.

The research papers to be presented are entitled as follows: "Some Experience in Design of Concrete Mixtures," by Bert Myers, Iowa Highway Commission; "Durability of Concrete," by C. H. Scholer, Kansas State College; "A Study of the Strength of Concrete as Made in Cuba," by Miguel Villa, Havana University; and, "Cost Economies in Concrete Bridges," by C. B. McCullough, Oregon state highway commission.

Coming Conventions

January 9-12—National Association of Paris Transit Mixed Concrete Manufacturers, annual convention. St. Louis, Mo.

December 11-12—Highway Research Board meeting. Washington, D. C.

January 19-22—National Crushed Stone Association, fourteenth annual convention. New Hotel Jefferson, St. Louis, Mo.

January 26—National Ready-Mixed Concrete Association, annual convention. Hotel Jefferson, St. Louis, Mo.

February 23-26—Concrete Masonry Association and Wisconsin Concrete Products Association, joint annual convention. Hotel Schroeder, Milwaukee, Wis.

February 24-26—American Concrete Institute, annual convention. Hotel Schroeder, Milwaukee, Wis.

EDITORIAL

Will Our Building Methods Be Changed?

MUCH has been written on the need for a fundamental change in the methods of building construction. Time after time writers and speakers have reminded us that, so far as dwellings and other small buildings are concerned, our building methods have changed little since biblical times. We still lay masonry units one at a time, by laborious hand-labor methods. Carpenter work is put together piece by piece, as in ancient times.

Interior and exterior plastering are done much as they were then. The result is that today the man of average means has most of his capital tied up in the home he lives in. Though the advantages of owning his home are many, he earns no income from this investment.

Several notable attempts have been made to get away from the old methods by making use of the fact that concrete can be cast in molds. Thomas A. Edison, some years ago, built concrete dwelling houses by casting the floors and walls in one operation, in metal molds or forms. The forms were rather expensive and the dwelling houses were too nearly alike in appearance. But the fact remains that the houses were built.

Who will carry the idea further, in the light of new developments since that time? We now have high-early-strength concrete and we have quick-setting cement, or we can add ingredients that make it quick-setting. We know much more about the making and manipulating of concrete than we did when Edison made his effort. And is it necessary to build the walls and floors entirely on the building site?

The chief trouble has been that too many impractical visionaries have attempted to take up the burden where Edison left off.

The man who finds and develops the solution will not be an impractical visionary. On the contrary, he will be a very practical man, who understands the possibilities of standardized parts and quantity production. He will be a man who has experience and the ability to develop his ideas, and enough wisdom not to attempt it without ample capital.

Conserving Water With Concrete Construction

ALMOST every great misfortune gives birth to new ideas. The nation-wide drought of 1930 is no exception to the rule, for it has directed the minds of thinking people toward the conservation of water resources—not alone for the semi-arid sections of the

country, but for regions in which irrigation has not been seriously considered prior to 1930.

And why not? If irrigation is good and profitable for the desert and semi-arid regions, many of which are remote from the leading markets, why would it not be better and more profitable in regions close to their markets but having normal rainfall? In such regions a drought of the severity of the one in 1930 occurs but once in a generation; but in every year, without exception, there are periods of inadequate rainfall and consequent crop damage, especially to vegetable crops.

It is now said that the great Pardee dam at Valley Springs, Calif., a concrete structure completed late in 1929 nearly two years ahead of the schedule, averted a water famine in the nine East Bay cities that financed its construction.

More significant is a story brought from Virginia by an engineer who has just completed a concrete dam and reservoir on a private estate. He assures us that many similar projects, both large and small, are seriously contemplated in that region, as an insurance against a repetition of the distress caused by the drought of 1930.

This may be the beginning of the practical application of an idea—one that may spread all over the older regions of the country where agriculture and the raising of livestock are important factors.

Hiding Too Long in the Storm Cellar

A RECENT digest of trade conditions, published by the Central Trust Company of Illinois, raises some questions about the excuse for pessimism over business conditions.

"With more gold than the country needs," says this digest, "with more credit than can be utilized, more dividend and interest payments than we have ever before enjoyed, more crops than we could possibly consume, and with average prices well below the level of average wages for the first time since the world war, it is hard to find justification for the current pessimism."

The digest then continues with the declaration that the pessimism seems to be based on a reduction of not more than 5 per cent in the total incomes of the people, a reduction of 5 per cent in the cubic content of building construction, and a reduction of not more than 3 per cent in the total disappearance of consumable goods.

A business depression is much like a rain storm. It starts because atmospheric conditions are right for a storm. The trouble at present is that too many business executives are still hiding in the cyclone cellar and don't know that the storm is clearing.

PROGRESS—In a Page

Current activities in research, in matters pertaining to concrete and cement, as being carried on or completed by various organized groups.

Highway Building Is New Extension Course

THE University of Wisconsin extension division is offering a new course in roads and pavements, given by correspondence study and intended to be of value for men who plan to specialize in highway work of any type.

This course is said to be suited, for example, to county supervisors having responsibility for highway building and maintenance, students contemplating careers in highway engineering, and beginners generally. It is conducted by H. E. Pulver, professor of civil and structural engineering.

The course treats of the scope of the highway engineering and the fundamental principles of highway design, construction, maintenance, and management. The technical phases include surveys and plans; the economics of highways; design of rural roads and city streets; the construction, operation and maintenance of various types of roads, such as concrete, and traffic regulation and control.

Rail Steel Bar Association Studies Rolling Problems

A NEW committee on Metallurgy, representing the Rail Steel Bar Association, 228 N. LaSalle St., Chicago, has been appointed for the purpose of carrying on the co-operative research work to be undertaken by the association as a whole.

The committee is expected to act as a consulting body on production problems for the entire membership of the association. Studies are now being made in each individual mill, with the idea of determining the special problems of each. This part of the committee's work will constitute a continuation of the activities of the present works managers division of the association.

It is expected that the activities of the metallurgical committee will develop into the establishment of a central metallurgical laboratory which will serve as a source of investigation and consultation in rolling problems.

Installation of Pulverized Fuel Systems

THE "Safety Code for the Installation of Pulverized Fuel Systems," sponsored by the National Fire Protection Association, has been approved as an A. S. A. standard by the American Standards Association, 29 West 39th Street, New York. The serial designation is Z12a-1930.

This code is a revision of the one approved in 1927. The revision was made necessary because the rapid increase in the use of pulverized fuel brought forward new developments in methods and equipment which the 1927 code did not cover in adequate fashion.

Terrazzo Floor Specifications

THE National Terrazzo and Mosaic Association, 809 St. Paul Avenue, Milwaukee, Wis., is preparing a revised

specification for placing terrazzo floors. Several existing specifications that have been in use for some time are serving as the guide for the new standard, and more recent knowledge of the art is to be included. V. F. Durner is secretary of the National Terrazzo and Mosaic Association.

Research Associate to Study Cinder Units in Bureau of Standards

THE National Building Units Corporation has arranged to place a research associate in the United States Bureau of Standards for the purpose of conducting a program of investigation to cover a number of years.

E. W. Bowen has been appointed to take charge of this work as research associate. He will study the performance of cinder concrete unit masonry, with respect to moisture movements, insulation, sound absorption, fire resistance, wall strength and related characteristics. A study of "Weldcrete," a combination of cinder concrete units and gunite, will be included in the investigation.

Cast Stone Detail Sheets for Architects

THE Cast Stone Institute, 33 West Grand Avenue, Chicago, Ill., is preparing a set of architectural detail sheets illustrating the use of cast stone in both exterior and interior work.

The detail sheets are to be published monthly, two or three at a time, and will be mailed to architects as a regular monthly service. Architects who want these details should write to the Institute and ask to be placed on the special mailing list now being prepared for the purpose.

Publication of the sheets is expected to be started within a very short time.

Bureau of Standards Investigation of Waterproofing Compounds

RAPID progress is being made with the investigation of waterproofing compounds which has for some time been under way at the United States Bureau of Standards. It is expected that the work will be completed by midwinter.

Some seventy-five commercial products sold as waterproofers of concrete have been covered by the investigation. Both integral and surface-applied waterproofing compounds have been included.

1930 A. S. T. M. Standards Ready for Distribution

THE 1930 Book of A. S. T. M. Standards, comprising two volumes with a total of about 2,300 pages, is now ready for distribution.

As previously stated on this page (September issue of CONCRETE), Parts I and II are printed in separate volumes, the former containing standards relating to metals and Part II covering nonmetallic materials.

In the Technical Society Journals

Ready-Mixed Concrete. The October (1930) Journal of the Boston Society of Civil Engineers, 715 Tremont Temple, Boston, Mass., contains a paper by Miles N. Clair, vice-president of the Thompson & Lichtner Co., in which the author describes the testing and strength control of ready-mixed concrete, the systems used in producing and distributing such concrete and the types of trucks employed. There is also a discussion of general experience with ready-mixed concrete, described as generally satisfactory, and a statement of the problems still remaining to be solved.

Exposed Surfaces of Concrete and Their Protection. A paper with this title, by A. B. MacMillan, chief engineer of the Aberthaw Company, appears in the October (1930) Journal of the Boston Society of Civil Engineers, 715 Tremont Temple, Boston. This paper deals with the problems of repairing old concrete surfaces that have started to disintegrate. Standard specifications for patching and specifications for painting, which comprise the practice of the Aberthaw Company, are given. There is also a discussion of measures which can be taken during construction to delay the beginning of disintegration on surfaces of concrete built in exposed places.

Mr. MacMillan is known to readers of CONCRETE as the author of a series of articles on concrete form work, printed throughout 1930.

Placing Concrete Canal Lining. A 34-page illustrated paper, by Arthur Ruettgers and A. A. Whitmore, describing the placing of 55,000 cu. yd. of concrete canal lining, on the Kittitas Division of the Yakima reclamation project in Washington, appears in the October (1930) Journal of the American Concrete Institute, 2970 W. Grand Blvd., Detroit, Mich.

About 52 per cent of the concrete is in the form of a 3-in. reinforced concrete slab. The work involved the construction of canal and tunnel linings, combination lining and flume sections, inverted siphons, culverts, turnouts, bridges and miscellaneous canal structures. Some novel construction methods were employed, and the concreting operations were scientifically controlled.

Construction and Design Features of Haydite Concrete. The October (1930) issue of the Journal of the American Concrete Institute, 2970 W. Grand Blvd., Detroit, Mich., contains a paper under this title, by F. E. Richart and V. P. Jensen. The paper contains information on proportions required to produce specified strength and workability, and on methods of quality control. Information for the structural designer includes data on the elastic behavior of the material and its action in a structure. The relatively low modulus of elasticity of haydite concrete is mentioned as a matter of considerable importance.

Concrete Masonry Units Cured With High-Pressure Steam. This discussion, by P. M. Woodworth, in the October (1930) issue of the Journal of the American Concrete Institute, 2970 W. Grand Blvd., Detroit, Mich., comprises a report on the final one-year tests on concrete masonry units which had been cured under high-pressure steam at the time of their manufacture. The results of tests at earlier periods had been described by the author in the February (1930) issue of the same journal.

From the tests over the entire period it appears that the

principal benefit from high-pressure steam curing is due to the higher strengths attained at early periods.

Successful Placing on Unusual Tunnel Job

An unusual installation of a mast hoist plant with two 1-yd. mixers in connection with a tunnel was made on the Figueroa street tunnel job at Los Angeles, California.

As shown in the illustration, the portal of the tunnel is on a side of the hill with a very limited area for carrying on operations. There was almost a perpendicular drop of forty feet, which allowed the contractor to install a 300 ton, 5-compartment steel bin. Under this bin was mounted a weighing box and under the weighing box the two 1-yd. Smith mixers were installed.

The contractor figured out a method to use his Insley mast plant and spouting to deliver his mixed concrete economically. His plan was to dig a small tunnel above the regular tunnel, thus allowing him to chute his concrete well in toward the center of the tunnel.

The project consists of three fairly short tunnels, each one approximately 450 ft. long. By this scheme the contractor was able to place all of the concrete of the heavy



Delivering concrete near center of tunnel

base section of the tunnel and at the same time remove the rock and preparations for the concrete from the far end and start placing the concrete when he was still removing rock from the end nearest the camera, without any interference at all, since the concrete was spouted toward the center of the tunnel.

With the two mixers operating, and with the batch-meters set at a $1\frac{1}{2}$ -minute mix, the hoisting and distributing plant had to take care of a yard of material every minute, which it did satisfactorily.

H. W. Rohl & Company, of Los Angeles, were the general contractors.

Research Comes Out of the Attic

Cement Industry Typifies Modern Idea of Research by Industries—Investigations That Lead to Better Cement, Better Concrete and Better Business—What the Industry's Largest Laboratory is Doing

By WYATT BRUMMITT

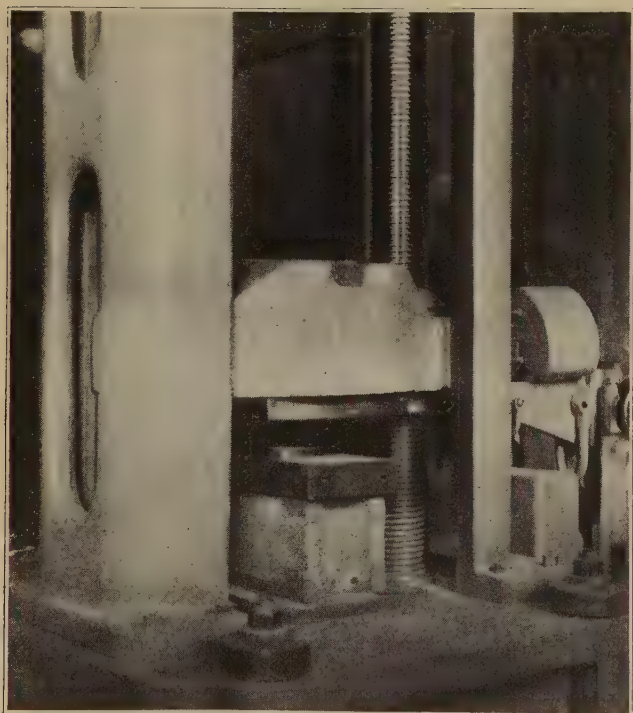
WITHIN the last generation research has undergone a revolutionary change. Formerly, the lonely scientist or inventor carried on his work in a secluded shop, working under handicaps of inadequate equipment and, in many cases, poverty. Today, industry has taken over the duties of research. Research laboratories are equipped with the finest obtainable mechanical equipment; groups of highly trained men work together, under conditions which leave them free to initiate and carry through proj-

half of the Portland Cement Association's five-story building in Chicago is devoted to the laboratory. Franklin R. McMillan, as chief of the research work, directs the work of half a hundred men. A fellowship for research is maintained at the Bureau of Standards, Washington, as a supplementary enterprise.

The Beginning of Research in Cement and Concrete

Organized research into cement and concrete was undertaken with a full recognition of the endlessness of the task. Work has begun with no definite goal in mind, but with a distinct consciousness of a need for larger and more definite knowledge of cement and concrete, as individual entities and in combination.

No investigation or research of any kind can be undertaken until standards are set, standards of terminology,



A unit of concrete masonry undergoing its final test to destruction

ects which, alone, they could not even attempt.

Industry's motive in research is, in no essential sense, different from that of the lone scientist struggling to win through to an unexplored territory—and to economic improvement. But there is this added significance. Keen inter-industry competition has made scientific progress, either in the product or in its uses, essential. The era of glorifying the status quo is as dead as the era of reverence for normalcy.

Typical of industrial research is the laboratory maintained by the associated makers of portland cement. Fully



A fresh lot of test cylinders being marked with the laboratory code numbers. Some will be kept years; others will have shorter lives. But when their history is completed, another fact may be cornered

standards of quantity and quality, and standards for making tests. Therefore, one of the very first projects which was faced by those who undertook researches in cement and concrete was the establishment of a suitable measuring stick by which to gauge every phase of the work.

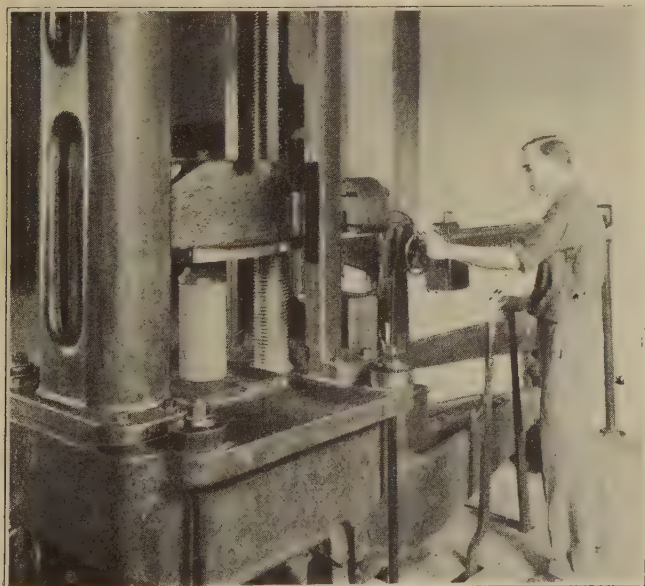
The Water-Cement Ratio Law

It was naturally assumed that strength was of vital importance in concrete. Numerous experiments were made to discover what effect varying the obvious factors

**Franklin R. McMillan,
Director of Research
of the Portland
Cement Association**



of cement content, quantity and proportion of fine and coarse aggregate, and time of mixing produced on the ultimate concrete. Oddly enough, in these original experiments, the water content was considered as of dis-



A test cylinder of concrete winds up its career in the 300,000-lb. compression testing machine

tinctly secondary importance. However, it was not long before the discovery was made that the amount of water used was a factor of very real importance. Every effort was made to discover, if possible, whether or not there was any definite relationship between the amount of water contained in a mixture of cement and aggregates and the ultimate strength of the concrete. From these investigations grew ultimately the law which has come to be known as the "water-cement ratio law" and which has estab-

lished an outstanding landmark in the progress toward a definite and scientific technique of concreting.

As has been indicated, every individual and minor department of research opened up new and unexplored territory. It was found, for example, that temperature, both in the mix and in the air during the curing process, played an important part in the ultimate quality of the concrete. Research into the effect of water brought with it a parallel research into the effect of impurities in the water. And the varying procedures in making tests on samples of concrete forced the investigators to establish standard methods of applying loads during the testing process and standard conditioning of the ends of specimens about to be tested. All of these individual, and in some cases minor, detours of investigations were inevitable in working on the broad problem of the design of concrete mixtures. The cumulative effect of these several inquiries has enabled men to predict the behavior of concrete, to work certainly with definite combinations of materials for various types of work.

Coincident with the establishment of the technique of concrete were problems of economy in the use of various materials. Inevitably studies of that type carried over into investigations of the use of various admixtures to improve the quality of the concrete itself where possible, or to achieve greater economy. The whole field of concrete admixtures is a fascinating and apparently endless one.

Compressive Strength Not the Only Factor

Original investigations were carried on with the idea that simple compressive strength was in itself the dominant gauge of quality in concrete. It was soon found that it was necessary to test concrete in beam form because of the wide use of concrete in the highway pavements which were rapidly developing throughout the country. Naturally, considerations of beam strengths bring into play an entirely new set of variables and factors. Similarly, it was necessary to consider tensile strength and its

allied problems, for pavements must resist direct shrinkage cracks.

Durability the Dominating Need

A recognition of the need for permanence in concrete grew to dominate all of the studies, for concrete's basic economic value lies in the fact that, properly handled, it can be relatively permanent. The investigators were faced and are still faced with ample evidence of impermanence in concrete, but sufficient data have been accumulated to indicate definite factors which, within limits, control permanence—or the lack of it.

As was natural, the early exigencies of the investigations focused attention on concrete, with relatively little being done in regard to cement itself, which even at the time investigation was begun was a fairly well standardized product. Still, there were certain basic phenomena which were accepted without complete understanding. For example, there were chemical mysteries in the reaction of raw materials in the cement kiln at the time of clinker formation; similarly, there were incompletely understood aspects of the part played by water when combined with cement or during the curing process. A basic interest in permanence led very naturally to research into the effect of various raw cement materials, the effect of grinding both raw and clinker materials, and the effect of various burning temperatures.

Running parallel with investigations into the chemical family history of cement and concrete, were investigations into the nature of concrete itself; for ample evidence revealed that, with a given cement, results were not always uniform.

Various types and combinations of aggregate, found in many different localities, were discovered to have some influence on the permanence of concrete.

This led to a study of structures in the field to scrutinize their behavior under widely varying conditions.

Studying a Quarter Million Experiments

The findings of perhaps a quarter of a million experiments are on file, experiments covering every known and some unknown aspects of the mysteries inherent in cement and concrete. Some of these may, with complete safety, be marked for the moment as finished. The data are complete and the results established beyond question. There are many others, however, which while seemingly satisfactory, may, as the work goes on, prove to be far from complete and possibly completely in error.

"But that," says Mr. McMillan, "is only one of the factors which makes scientific research both worth while in a general sense and enticing in a thoroughly human sense."

Research in cement and concrete, like research in any other general field, is not static, but dynamic to the highest degree. It must move and move quickly when the occasion demands. Every day new uses are being found for concrete and each new use brings with it problems which may or may not have been met before. New trends in human interests produce new problems.

For example, the current interest in and demand for color has had a direct influence on the technique of concreting. Problems appeared in the use of color with concrete and cement which were wholly unrealized before this trend made itself manifest. Study of the use of color in concrete cannot yet be called complete, but sufficient data have been collected to establish a workable and reliable technique for colored concrete.

"Our research in concrete," says Mr. McMillan, "may be compared to a two-ended top, or to two cones joined together at their peaks. When we began our work the

field was almost hopelessly wide. We were dealing in unknowns. However, as we went ahead we slowly narrowed down our enterprise until we at last arrived at a fairly definite working base, a point which might be termed the apex of the first cone.

"But immediately the field began to widen again, as more and more diverse problems appeared, to be attacked on the basis of the technique we had established. We cannot say where this work will lead. Nor do we expect ever to reach the base of this second cone. In fact we may be forced to narrow down again under the influence of some new or revolutionary development."

The immediate projects facing the researchers in cement and concrete may be divided into three general classifications. The first is continued analysis and refinement of the cement-producing process, in search of a possible improvement in the product itself and of improved methods of manufacture. The second is a perfected technique of using concrete under conditions which some pessimists consider as impossible. And the third is adapting concrete to a widening range of uses, a range which today extends from airports to garden ornaments and from silos to skyscrapers.

Road Builders Study Equipment and Ready-Mixed Concrete

Highway equipment authorities representing the federal, state, city and county governments met Saturday, November 15th, in Pittsburgh, for study of equipment problems, at the call of M. De Glopper, materials and equipment engineer, Michigan state highway department, and chairman of the equipment committee of the American Road Builders' Association.

Both manufacturers and users of all types of construction and maintenance equipment are represented on the committee groups dealing with special questions. Contractors, representatives of various associations in the highway industry, the technical press, engineering schools, railroad maintenance organizations, and airport engineering departments are represented on the committee.

The study of equipment has been divided into six sections to take up special investigations. The final reports will be drafted and presented at the twenty-eighth annual convention and road show of the American Road Builders' Association in St. Louis, January 10th to 16th.

A general specification to meet the average conditions of plant, transportation and placing in street and road work will be the objective of the committee on central and transit mixed concrete. Its work will deal with the handling of concrete from the time it leaves the central mixing plant until it is laid on the subgrade.

Illinois Sets New Road Mark in Total Mileage

By E. E. DUFFY

By reason of her excellent financing methods and comprehensive planning, Illinois will this year complete the equivalent of her nine-thousandth mile of 18-foot hard surfaced rural roads.

Back in 1924, Illinois set a year's construction record which still stands of 1,113.5 miles of concrete. By November 1st of this year Illinois had awarded contracts for the building of the equivalent of 1,044 miles of 18-foot pavement, and will complete 830 miles this year. The differential is explained by the fact that contracts for lengthy mileages to be built next year have been awarded this fall so that work can start immediately in the spring.

Precast Concrete Camp Stove May Be Profitable Specialty

Design Developed for Cook County Forest Preserves—Unit Contains Two Cubic Feet of Concrete

A precast reinforced concrete camp stove that is giving excellent service has been developed by the Forest Preserve District of Cook County, Illinois, for use in the forest preserves owned and maintained by that organization.

The material required for a stove consists of 2 cu. ft. of concrete and 18 lb. of round steel bars. As will be seen in the detailed drawing, the bill of bars consists of the following items:

Mark	Size	No. Req'd	Length
A	$\frac{3}{8}$ in. round	2	5 ft. 6 in.
B	$\frac{3}{8}$ in. round	4	10 in.
C	$\frac{3}{8}$ in. round	4	11 in.
D	$\frac{3}{4}$ in. round	5	1 ft. $7\frac{1}{2}$ in.

The bars marked A are bent at an angle of 90 deg. at two points, 24 and 42 in., respectively, from one end.

The $\frac{3}{4}$ -in. round bars marked D serve as a grate for the stove, while at the same time they add to the rigidity of the unit and facilitate its handling.

A good mixture for the concrete is 1 part of cement, 2

that may be lost or carried away. It is therefore suitable for use in tourist camps and other locations where attendants are not constantly present.

Charles G. Sauers, under whose direction these camp stoves were developed, is general superintendent of the Cook County forest preserves.

Plans Forming for Banner Products Meeting

A joint committee, representing the Concrete Masonry Association and the Wisconsin Concrete Products Association, is pushing plans for the combined conventions of the two organizations, to be held in Milwaukee, February 23rd and 24th.

Some of the subjects on which there will be discussion are—"Selling Concrete Tile Against Clay Brick," "The Value of Research in a Merchandising Campaign," "Selling Light-Weight Units in a Highly Competitive Market," "Underwriters Tests as a Sales Asset," "The Possibilities of Random Ashlar Construction and How This Business May Be Developed," "Aggressive Salesmanship Really Builds Business," "How Diversification of Products Pays in Slack Times," and "How the Products Manufacturers Can Use Direct Mail."

Believing the American Concrete Institute program, which starts on February 24th and continues through the 26th, will adequately take care of the manufacturing and technical end of the concrete products business, the committee has based the program almost solely on merchandising and advertising problems.

All sessions of the convention will be held at the Hotel Schroeder, Milwaukee. Registration starts at 9 o'clock Monday morning, February 23rd. Convention sessions start that afternoon and continue until late Tuesday afternoon, the 24th, when the convention will adjourn to formally join hands with the American Concrete Institute.

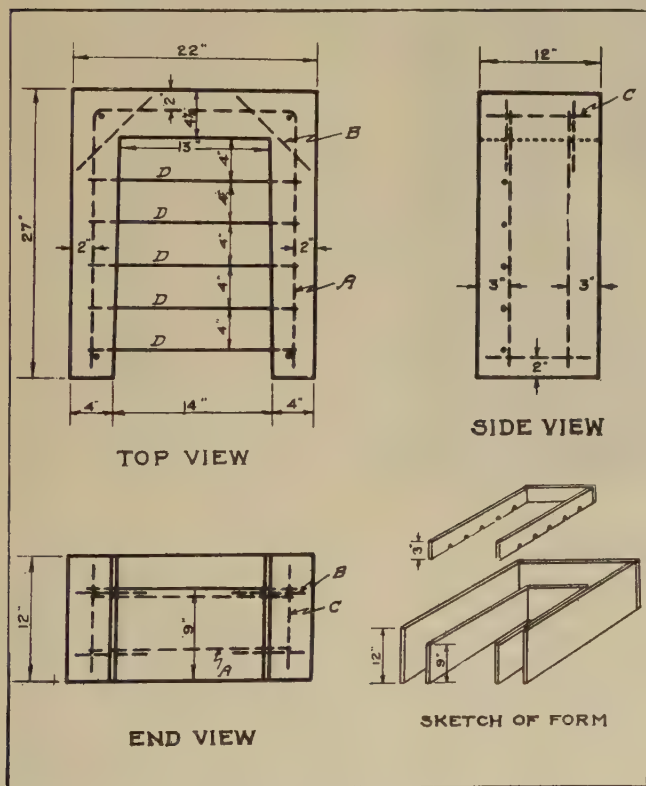
New Design Charts by Griffith

A new series of design charts by James R. Griffith, author of "Reinforced Concrete Design Simplified," will be published in "Concrete" during 1931.

The new series, like the past work of this writer, will provide convenient charts to serve as very practical aids to structural designers who deal with buildings and similar structures. The new charts will cover some of the following problems, such as a designer encounters in his daily work:

- (1) Unbalanced reinforcement in beams and girders.
- (2) Intensity of pressure under footings.
- (3) Bending moments in wall footings.
- (4) Bending moments in column footings.
- (5) Earth pressure against foundation walls.

Readers who are familiar with Prof. Griffith's series on "Reinforced Concrete Design Simplified," concluded in this issue, will know what to expect in the new series. New readers will soon realize the practical value of the charts. They will constitute convenient short-cuts for architects who do their own structural designing work, no less than for structural engineers.



Details of reinforced concrete camp stove for use in Cook County forest preserves

parts of sand and 3 parts of coarse aggregates not exceeding $\frac{1}{2}$ in. in size. Knock-down forms of heavy material should be used, as shown in the detail. When the forms are removed the unit should be covered with burlap and kept damp for ten days. The weight of the unit may be greatly reduced by the use of light-weight aggregates instead of sand and stone or gravel. A further advantage of the use of light-weight aggregates is seen in their fire-resistive qualities, a matter of some importance because the stoves will of necessity be subjected to frequent heating and cooling.

It will be observed that the stove contains no loose parts

Applying Industrial Methods to the Products Industry

MANUFACTURERS of concrete building units in particular, and of concrete products in general, can now be informed that our January issue will contain the first of a series of articles that will be of great value to the products industry. The series will deal with the products manufacturing business as an industry. The author will discuss the ailments of the industry, and will show how to apply industrial methods to the cure of those ailments, whether the plant is small or large. Plants of average size will be taken as the basis for the data and discussions to be presented.

These articles will cover the entire range from the analysis of previous sales records through the material handling and manufacturing operations to the selling and delivery of the product. Following are some of the industry's problems which will be dealt with in a comprehensive manner, yet in language that is easily understood:

- (1) Analysis of the industry
- (2) Scheduling the output
- (3) Plant layouts
- (4) Preparation, handling and storage of raw materials
- (5) Manufacturing the product
- (6) Storage and delivery
- (7) Simple office and sales records
- (8) Sales and market analysis.

Fred A. Sager, author of these articles, has had extensive experience in the concrete products industry, both directly and indirectly, but his broad professional experience has placed him into intimate contact with many other industries and public utilities.

After graduating from the course in electrical engineering at the University of Michi-

gan in 1894, he taught electrical engineering and physics at the University of Illinois until 1903.

From 1903 to 1924 he was with the well-known Chicago engineering firm headed by Bion J. Arnold, whose activities touched all

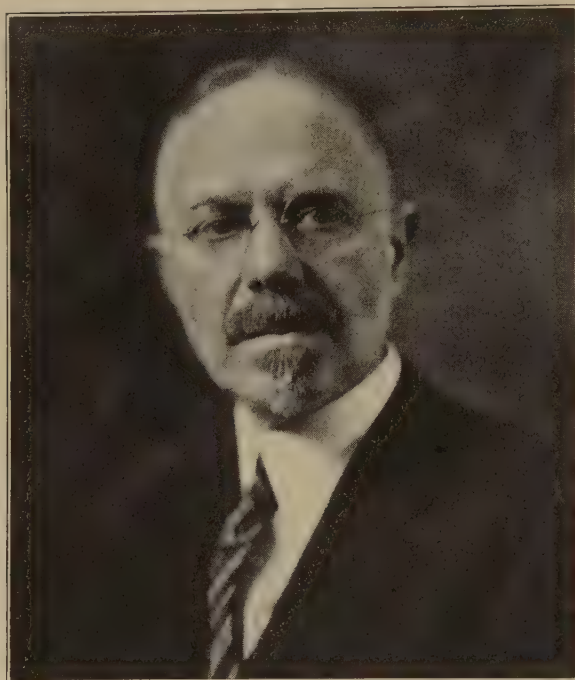
branches of industrial engineering. During this time Mr. Sager was engaged in making investigations in rate cases and in appraisals and analyses of operations of public utilities. The design and construction of industrial plants, power plants, hydro-electric developments and irrigation systems occupied much of his time. He also gained much valuable experience—perhaps the most valuable in his long career—in the difficult task of revamping the production programs of unprofitable manufacturing concerns.

In the two-year period from 1924 to 1926 Mr. Sager developed his first in-

timate acquaintance with the concrete products industry. This came about through his association with E. B. Cadwell & Company, of New York, fiscal agents for the Crozier-Straub organization. During these two years his special work was that of organizing and developing plants for the manufacture of cinder concrete building units. Hence in his first acquaintance with the industry, he acquired the habit of thinking of a concrete products plant as a manufacturing enterprise.

Since 1926 Mr. Sager has been connected even more intimately with the manufacture of concrete building units, partly as treasurer and part owner of the Illinois Concrete Products Corporation at Forest Park, Illinois, and partly in a consulting capacity.

CONCRETE PUBLISHING COMPANY.



Fred A. Sager, who will tell in forthcoming articles how to apply industrial methods to concrete products manufacturing

Profitable Manufacture of Concrete Building Units

By FRED A. SAGER

THE business of production and sales of concrete products exhibits the widest range in methods adopted and used by the various concerns engaged in this line of activity. Concrete products plants are found in large and in small communities. Many plants are large and well managed. Possibly more are small and poorly managed. Small well managed plants are also found. In this respect, the products industry differs no whit from other lines of manufacturing and commercial activity.

Impetus Given Industry

While not a new industry, recent developments, such as the use of light-weight aggregates, have given it so great an impetus that in its present state it may be considered comparatively new; and this very newness of the business is attended by wide variation in the results in the operation of individual companies.

This has been the usual history of industries. In the field of transportation, the development of the electric motor entirely changed the scope of operations of the street railways and opened the field for the construction and operation of interurban systems. The novelty and the prospective profits of the business directed the efforts of promoters and the money of investors into this field on a large scale during the double decade about 1900. The result was the usual one—success to some and failure to many. In many cases the persuasive power of promoters was responsible for the construction of properties whose location and lack of possible patronage doomed them to failure. In others, lack of proper design and equipment soon led to their fall in competition with better properties.

Similar history may be noted in the case of the telephone industry, but with a very different final development. The Bell system early established standards of design, construction and operation, which standards were in turn passed on to all of the subsidiary operating companies.

Efforts have been made in the concrete products industry, and will be made in increasing degree, to collect and disseminate information as to methods and practice designed to advance the art and improve the operation of the individual companies. These efforts indicate the necessity of and desire for all possible information on the part of the companies to the end that the industry shall develop along economic and successful lines.

Assuming a market for a reasonable output for a given plant, the business of the operating company is to produce and deliver to the satisfied customer a good product, suited to the customers' needs, at the lowest production, sales and delivery costs. Many elements enter into these costs, some of which are generally recognized and figured; many of which may not be recognized or figured. To analyze all

costs to a high degree of accuracy may be desirable in the largest plants, but in the small average plant the cost of such an analysis might be more than it was worth. There should, however, be a fair understanding of the various elements of cost entering into the entire business operation, and the necessary costs must be known and controlled to insure the successful operation of any business, however small.

Improved Business Methods

If by the keeping of simple records, a small plant can change its manufacturing schedules from a haphazard to an orderly one with a resulting saving, such course should be adopted. If other records will permit of the furnishing of all customers' requirements with a reduction of 30 per cent in the inventory of finished stock, a corresponding amount of capital will be free for use in the business.

The fundamentals of good plant design should be known and if not embodied in the present plant layout, should be worked into it as development and changes in the plant take place. The most suitable equipment should be used, though in some cases this may not mean the most efficient machine. A small plant with sales of 100,000 equivalent 8-inch units per year, would be better off with small investment in a modest machine, than with several thousand dollars tied up in a machine capable of producing its entire output in a month.

In the large and the small plant the problem of receiving and storing a comparatively heavy aggregate, the handling of tons of the aggregate and finished products through the plant in manufacture, the storing and delivery of the finished product, is the same and should receive the same fundamental consideration. A given number of tons of material have to be handled and processed at a minimum cost. The arrangement of facilities, the cost and amount of land and buildings must be adapted economically to the needs of the individual business in accord with simple principles applicable equally to the small as to the large plant.

Purpose of Articles

It is the intention, in a series of articles, to analyze the business of a moderate sized plant, such analysis being based on the actual deliveries of a small plant, and from such study to arrive at certain fundamental conclusions as to stocks of all types to be carried to properly handle the business; plant required to produce the product; general features of economic plant design and use of plant land, including the handling and storing of raw materials, processes of manufacture, curing and storing the product; the use of simple records to interpret promptly the current costs of production and sales and suggestions as to the general financial records of the business; the matter of deliveries and of contact with the customer

during deliveries; and matter pertaining to markets and sales.

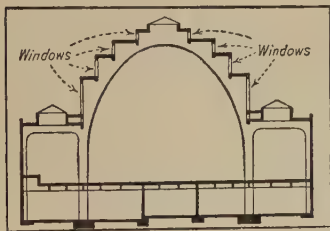
The concrete products industry is in a stage of rapid development. It is sure as fate that the success of the individual company will be commensurate with its appreciation and use of the simple fundamentals of the concrete products business, many of which are common to other industrial enterprises.

Reinforced Concrete Hall Designed for Clerestory Lighting

The design of the Horticultural hall, London, completed some time ago, constitutes a striking departure from established London building practice. The building is of reinforced concrete. The unusual design of the roof of the hall, and to some extent the constructional material, are the outcome of a desire to secure more adequate and pleasant distribution of daylight to plants and flowers staged in the hall during the exhibitions, and a more even temperature than is possible with the every-day methods of construction used in what may be called the railway depot type of roof, of which London's old horticultural hall is an example.

In the new hall daylight enters chiefly through continuous vertical windows that suggest the clerestory lighting of a Gothic cathedral. There are four tiers of these windows arranged step-fashion on the reinforced concrete

arches which span the hall and divide the long lines of windows into sections. There is nothing new in the use of single tiers of clerestory lights in roofs, but its evolution into a complete system of



lighting for a large exhibition hall is decidedly new to the United Kingdom. It has, however, been employed with success on the continent of late years, and there are fine examples of it in the new cattle market at Lyons, the Radio Exhibition hall at Berlin, and at Breslau in the concert and conference hall. It was also used to admirable effect in the assembly hall of the Gothenburg Exhibition of 1923.

Foundations

The foundations of the new hall rise on a deep deposit of clean, water-free sand in a place only a few hundred yards from the River Thames, where a deposit of peat or alluvial soil might be expected. The sand has been used in the structure, and the arches and beams reveal their composition as well as their function. In the interior of the hall no plaster is used, and the surface of the concrete is hammered to remove the film of gray cement which comes to the surface and hides the natural color of the material. For the purpose of this building, reinforced concrete is highly appropriate, and its frank expression for the first time in Great Britain in a building of a public character needed courage on the part of the architects, Easton and Robertson. The architects' technical advisor was Dr. Oscar Faber, a well-known concrete expert.

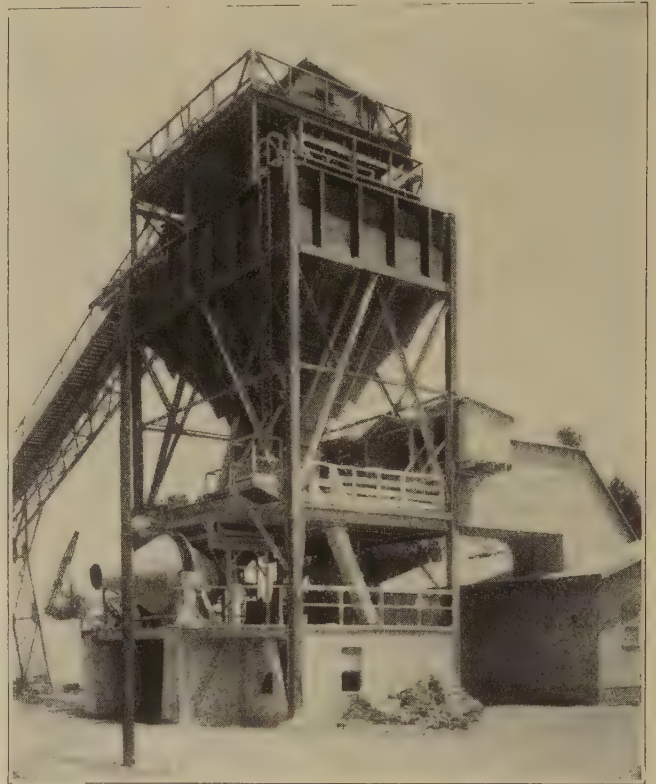
Ready-Mixed Concrete Convention

The National Ready-Mixed Concrete Association will meet in annual convention at the Hotel Jefferson, St. Louis, Mo., on January 26th.

Two Mixers Under One Bin Double Capacity of Ready-Mixed Concrete Plant

A slight change in their plant set-up has enabled the Woodstock Slag Corporation of Birmingham to operate two mixers simultaneously under one bin, with as short a mixing time as one minute. This company has for several years produced ready-mixed concrete for contractors in and around Birmingham, and the new set-up has practically doubled the plant capacity.

The original plant set-up included a 4-compartment bin, one weighing batcher, and two T. L. Smith tilting mixers,



Ready-mixed concrete plant in Birmingham doubles capacity by installing two mixers

one a 28-S and the other a 56-S, placed back to back. With this arrangement it was possible to operate only one mixer at a time, unless an exceedingly long mixing time was specified. It was impossible to add another weighing batcher without completely redesigning the bin.

By building chutes from the four bin compartments directly to the mixer hopper, and installing a 56-S Weigh-Mix in place of the 28-S mixer, the owner was enabled to operate both mixers at the same time. The weighing hopper proportions the batch for the one mixer, and the "weigh-mix" device takes care of the other.

American Tile Company Purchased by Federal

The Federal Cement Tile Company, Chicago, announces that it has acquired the American Cement Tile Manufacturing Company, Pittsburgh, Pa.

Executive and general offices will be at Chicago. Plants are at Hammond, Ind., Lincoln, N. J., Wampum, Pa., and Birmingham, Ala.

It is proposed to name the company the Federal-American Cement Tile Company.

How to Save in

Concrete Form Work

Type of Labor—Scope and Nature of Cost Estimates—
Re-Use of Form Lumber

XII—Estimating the Cost of Form Work

PART I

By A. B. MacMILLAN

Chief Engineer, Aberthaw Company, Boston, Mass.

This is the first part of the final installment of Mr. MacMillan's series of articles on concrete form work, the first of which was published in the January (1930) issue. In this final installment the author undertakes what is probably the most difficult phase of the entire series, namely, estimating the cost of form work.

The estimates must of necessity be based on quantities of material and number of labor hours required, so that local prices for such material and labor may be applied to the estimated quantities. Without these cost estimates the series would not be complete. —The Editors.

NO one has more reason than the writer to realize the difficulties of establishing the necessary bases on which the cost of form work may be estimated in advance. The best that can be accomplished is to assume certain average conditions and express the required form work for a given area in terms of material quantities and hours of labor. The reader may then follow similar methods in the figuring of his own form work problems, and arrive at the estimated cost by applying the unit prices prevailing in his community for material and labor.

Cost estimates for metal forms and for special systems of form construction will not be given, for several reasons. In the first place, metal forms and various special systems, many of them covered by patents, are for the most part erected and removed on a lump sum basis by the companies that make or control them. Consequently the general contractor will not actually estimate their cost. He will know what a special system of form work will cost him if he sublets it on some such basis. His only interest then lies in the question as to whether he can do the work himself for less money, by erecting ordinary wooden form construction of the kind described and illustrated in the previous chapters. After all, then, we get right back to the fact that the ordinary wooden forms are the only kind that the general contractor needs to figure.

A second reason for avoiding the attempt to estimate the cost of metal forms and special systems of form construction is seen in the great number of such systems. Once the attempted estimates were undertaken, there would be no place to stop.

The difficulties of estimating the cost of ordinary wooden forms may be comprehended when we consider the

variable elements in both material and labor. The cost of material varies not alone with the price of the lumber. A much greater variation arises from the number of times that the same lumber can be used. For illustration, compare a 2-story reinforced concrete building with a 6-story building of the same ground area. In either case, floor form panels, beam sides and column forms will be made in sufficient quantity to concrete two floors at a time. On the 2-story building these forms are used once; on the 6-story building they are used three times. The cost of the material for the floor form panels, beam sides and column forms is therefore as much for the 2-story building as for the 6-story structure; but in the taller building it goes three times as far. To put it in another way, the *material* for this part of the form work costs three times as much *per square foot of surface area* on the 2-story building as on the 6-story job. The same is true in lesser degree with respect to other parts of the form work.

Form labor costs are variable only to a moderate extent because of differences in labor rates. The experience of the form work crew and the experience and ability of the foreman are of far greater importance. One experienced foreman who plans his work ahead and makes up his forms in units that are easily assembled and removed will do twice as much as a less able man.

Importance of Plans and Layouts

Mention was made, in the fifth chapter, of the importance of having form work properly laid out by means of key plans and details. This cannot be emphasized too strongly or too often, for without layouts and details, material will be wasted, and time will be lost in re-cutting and refitting material that was cut to the wrong dimensions. Still more time will be wasted in looking for lengths and sizes of lumber needed. Form work can not be erected expeditiously if there is a lack of system and organization in the operation of the crew.

As mentioned in the former discussion of this subject, if the contractor's organization is a comparatively small one, and does not include a drafting department, he can get his form details prepared by an architect or a structural engineer, or by one of their assistants who will do the work on his own time. In some of the larger cities structural engineering firms specialize in such work. The cost of having the work done will be saved several times over because of the saving in labor and material and the greater salvage value of the form lumber used.

Inasmuch as the extent to which common labor is employed will enter into the cost estimates to be given, the wisdom of using such labor may well be discussed at this point. In the larger centers such as New York, Boston,

and Chicago, the answer to this question may be governed by the rules of union labor. In the smaller cities, where union labor rules have less influence, the contractor may be free to use his own judgment about employing common labor along with carpenter labor in the form work crew. If the contractor, under these circumstances, decides to use common labor on work such as form removal he may find it an expensive privilege. Forms will be in much better condition for re-use in the next floor above if taken down by the carpenters who assembled the work, and they will also do the work in less time than common laborers will do it.

Common labor may be used in cleaning the forms and hoisting them to the next floor, for carrying form lumber and made-up form units from place to place, for gathering up bolts and other accessories, and for other work of this nature; but beyond this such labor should not be employed.

Scope and Nature of Cost Estimates

From what has been stated in regard to the number of times that certain parts of the form work can be used, it must be clear that this extremely variable element must be estimated for each construction job. The illustration given in the case of the 2-story building and the 6-story building shows the great variation possible, even with buildings of moderate height.

It will, therefore, be best to take typical details of form work of the kind shown in the previous articles of this series, assume certain average conditions, then estimate the quantity of material and the number of hours of labor required for a certain number of square feet of form work. The estimates for hours of labor will be separated into various parts of the work, such as making up the forms, erecting, removal, cleaning, hoisting to the floor above and redistributing, so that each of these items can be estimated on the basis of the class of labor employed. The cost of making up the forms will, of course, be affected directly by the number of times the various form units can be used.

Some allowance must also be made for time spent on repairing form units and patching out around column heads and girder ends where column sizes are reduced. Here, again, there is great variation between jobs. For instance, let us consider again a 2-story reinforced concrete building of beam and slab design and a 6-story building of the same type and ground area.

Considering first the 2-story building, if the designer is an experienced man who knows his business he makes the column sizes the same in both stories, merely reducing the steel reinforcement in the second-story columns; and he makes the dimensions of the roof beams and girders (the part below the *bottom* of the slab) the same as the floor beams and girders, merely decreasing the steel reinforcement in the roof members. In such a case practically no patching out or altering of form work will be required. On the other hand, if the building is designed by a less experienced man who makes the second-story columns smaller than the first-story columns, and the roof beams and girders smaller than the corresponding floor beams and girders, the column form work must be altered and the bottoms and sides of beams and girders must be reduced in width and patched out at the ends.

Similarly, considering a 6-story building, an experienced designer will maintain the same column sizes from top to bottom, and the same beam and girder dimensions below the bottom of the floor and roof slabs. In this case no alterations or patching out will be required. A less experienced designer will change column sizes about every second story and will reduce the cross-section of roof

beams and girders, thereby necessitating much alteration and patching out.

Bills of material, for the areas assumed in the estimates, will also be given. The estimator of form work quantities and costs may then apply these estimates for limited areas to each individual construction job. One of the difficulties will be that of estimating the number of times the individual parts of form work can be used, although this problem comes up mainly in the case of buildings of many stories.

Re-Use of Form Lumber

The quantity of form lumber required will depend very largely on the number of times the material can be used, although the care with which it is used will in turn affect the number of times. The following points may therefore be of assistance to the estimator, although he should not accept them blindly.

(1) For foundation walls and wall footings of a building of moderate ground area it is best to provide sufficient form material for the entire area, so that the concreting of this part of the structure may be done in one operation. In a building having large ground area, where foundation form work can be erected to keep the concrete mixing plant going for about three days, it will be economical to put up only a part of the form work, moving it the second day after concreting is completed. In the meantime the mixing plant may be occupied in supplying concrete for column footings and other work, turning again to the foundation walls and footings as soon as the forms are re-assembled. In this connection, keep in mind that a 1-yd. mixer will turn out about 240 cu. yd. of concrete daily. For a 3 days' run, therefore, form work must be erected for about 700 to 750 cu. yd. if the mixing equipment consists of a single 1-yd. mixer, and proportionately more when larger or a greater number of mixers are used.

(2) For column footings, sloped footings especially, much labor is involved in making up the forms, and not much of the material can be used elsewhere. It is therefore economical to make up only enough footing forms so that they can be used at least four or five times. These footings can be concreted between runs on foundation walls, and the forms can be stripped and moved to the next location the day after concreting.

(3) Forms for columns, for sides of beams and girders, for ordinary floor slabs, for flat-slab floor construction and for walls above grade should be made up in sufficient quantity for two stories if the construction schedule contemplates erecting one story per week. If the construction schedule calls for the erection of two stories per week, forms for the parts just named must be in sufficient quantity for three stories. When forms are made up in units that are conveniently assembled and removed, as they should be, the material can be used from six to eight times without requiring additional lumber for renewal. Allowance should be made for about 10 per cent additional lumber for each time of use after the sixth.

(4) Material for posts, jack frames, braces and other material required to support floor form work must be supplied in sufficient quantity for three stories if the construction schedule calls for erecting one story per week, and sufficient for four stories if the schedule contemplates erection of two stories per week.

(5) Beam and girder bottoms are left in place, along with the reshoring timbers and their braces, much longer than the remaining form work—usually about 18 days after the floor is concreted. Consequently the quantity of material for these purposes must be sufficient for four stories if the construction schedule calls for erection of one story per week, and for seven stories if the schedule

contemplates erection of two stories per week. Quite naturally, these requirements are modified if the total number of stories in the building is less than four in the one case, or less than seven in the other. The number of bottom planks required can be reduced by making special provision for removing them at the time the beam and girder sides are stripped. This can be done by replacing the bottoms one at a time with short pieces of plank at each reshoring post.

(6) Materials for the rough structural parts of stairways and miscellaneous rough work need not be ordered separately, for the reason that this work is often done after the main part of the structural concreting is completed, so that rough form lumber can be salvaged from the material previously used. Form lumber for the risers, nosings and other finished parts of stairways, and for the exposed faces of sills, copings and similar accessory parts in some cases requires millwork, and in all cases it must be well-dressed lumber of good quality.

New Books and Pamphlets

Concrete-Encased Pipe Results

BULLETIN 93 on Results of an Investigation on Supporting Strength of Concrete-Encased Pipe.

Published by the Iowa Engineering Experiment Station, Iowa State College, Ames, Iowa, in co-operation with the Clay Products Association, Chicago, Ill.

It was found that the safe supporting strength of concrete-encased clay pipe is only slightly greater than the sum of the individual supporting strengths of the clay pipe and of the concrete encasement. The supporting strength of the encased pipe was found to be higher at lower temperatures. The action of an encased pipe is very nearly that of two independent but concentric rings, results showed.

Tests indicated that the strength of a concrete specimen is influenced to a marked degree by the temperature at which it is tested. Specimens tested at 1 deg. F. were found to have about double the ultimate strength of specimens made and cured under the same conditions but tested at 70 deg. F.

Review of Airports

INTERNATIONAL AIRPORTS. By Stedman S. Hanks, Lt.-Col., Air Corps Reserve. Published by the Ronald Press Company, New York. Illustrated, 5½ by 8½ inches, 195 pages. Price \$5.00.

The author made a tour of the principal airports of Europe during the summer of 1928, and this book is one of the results. Because of the greater experience of European air transport organizations in operating international air services most of the descriptions and illustrations are taken from that side of the Atlantic, although some American airports are illustrated. To designers and builders of American airports this book will bring much useful information.

Shore Protection Structures

CONCRETE SHORE PROTECTION. Published by the Portland Cement Association, 33 West Grand Avenue, Chicago.

This booklet points out the adaptability of concrete for shore protection structures and gives a suggested specification which will insure concrete to withstand conditions of exposure and service that prevail in any locality.

Concrete Construction Made Easy

CONCRETE CONSTRUCTION MADE EASY. By Leslie Turner and Albert Lakeman. Published by Concrete Publications, Ltd., London. 113 pages, 5½ by 8½ in.

The builder of concrete structures of small or medium size will find in this book much useful information in the design tables and details, and in the form work details for footings, columns, girders, walls, stairways, roof trusses, water tanks and retaining walls. The text discusses construction methods on various types of work, and closes with specifications written with particular reference to the reinforced concrete construction work described in the book.

Compilation of Articles and Papers on Research

FIVE YEARS OF RESEARCH IN INDUSTRY, 1926 to 1930. Compiled by Clarence J. West. Published by the National Research Council, 29 West 39th Street, New York. Paper cover, 91 pages, 6 by 9 inches. Price 50 cents.

This compilation consists of research reading lists under various headings, including cement and concrete, construction and highway engineering. The compilation covers practically the entire industrial field, and the bibliography is necessarily limited to articles and reports of outstanding importance.

Lime in Concrete

LIME IN CONCRETE, by C. E. Ellsworth, chief engineer of the Construction Division of the National Lime Association, is an attractive and well written booklet on the use of hydrated lime as an admixture in concrete. Paper cover, 20 pages, 6 by 9 in. Published by National Lime Association, Washington, D. C.

Personals

Charles B. Bryant, for the past eight years connected with the Portland Cement Association in field engineering work in Virginia, Pennsylvania and Maryland, has been appointed senior assistant highway engineer of the State Roads Commission of Maryland.

C. E. Ellsworth, 5130 Connecticut avenue, Washington, D. C., has announced his resignation as chief engineer of the construction division of the National Lime Association. Mr. Ellsworth was formerly secretary-treasurer of the Rice-Jones Company, general contractors, chief of staff of Warren D. Spangler, Inc., power plant engineers, and assistant chief engineer of the Gulf Refining Company.

Erwin M. Lurie, for the past nine years assistant to the commissioner of the Associated Metal Lath Manufacturers, has been promoted to the position of acting commissioner of the group.

Much of Mr. Lurie's activity has been in the analysis and revision of over 100 building codes.

H. A. Schaffer, formerly conservation engineer for the Portland Cement Association and later with the Bates Valve Bag Corporation, has been engaged since May of this year in special investigations and consultation for the Western Precipitation Company, Chrysler Building, New York. His work deals in particular with the recovery of dust by electric precipitation.

Lower Production Costs are Coming

Era of Price Increases Believed Ended—Skies Beginning to Clear, But Future Outlook Points to Keener Competition—Trimming Unit Production Costs is Problem Facing Contractors and Products Manufacturers

THE concrete construction and the concrete products manufacturing industries will join many others in bidding farewell to 1930 with mixed feelings of regret and sighs of relief—regret because one more year is passing, and sighs of relief because the worst is over and the skies have begun to clear. The business barometer gives promise of fair weather in a little while.

Even though the skies show signs of clearing, a few additional but temporary squalls or showers may descend upon us, for a protracted storm does not come to a sudden end.

But in spite of what has happened, or what may happen within the next few months, the construction industry has before it the encouraging fact that in the November elections the voters took favorable action on proposed bond issues totaling hundreds of millions of dollars. These bond issues will be translated into new construction work as rapidly as possible, all of which should have a stimulating effect on the construction industry throughout 1931. Added to this there are a number of public projects, such as the Chicago postoffice, for which appropriations have been made and work will soon be started.

Another favorable factor is seen in the hard lessons learned from 1930. No matter how grievously the past twelve-month period has affected individuals and individual concerns, it has taught us many things that can be made of permanent value as a guide for the future conduct of our branches of industry.

First of all, we have learned that while the effect of depressions can be softened by emergency measures such as increased public construction, such depressions can not be prevented, just as the excesses preceding them can not be prevented.

In view of the assertion just made regarding the inevitable recurrence of depressions, it behooves each concern to build up a substantial surplus so that future financial storms can be met and lived through without acute distress. Expansion policies that expand too rapidly should be avoided.

Much has been heard during 1930 about the evils of price-cutting, but the experience of this year has shown that when prices are low enough, buying is resumed. While everyone is aware of the evils of sudden or drastic price cuts and the blighting effect of selling at or below actual production costs, the trend in all industry is toward the gradual lowering of prices through the lowering of production costs. Here again the automobile industry is showing the way to others, for some of the largest companies have already announced substantial price reductions on 1931 models.

Reduced production costs, however, should not be accomplished through the reduction of wage and salary scales, for such action would automatically reduce the nation's buying power. A gradual increase in wage and salary scales would just as automatically increase that buying power.

The contractor, the products manufacturer and all others connected directly or indirectly with the concrete construction industry must depend on better planning and better management as the means of reducing production costs. Needless overhead expenses should be eliminated, just as all other forms of waste should be avoided. More and more dependence must be placed on material-handling equipment and other cost-reducing equipment and machinery.

Products manufacturers must continue the tendency toward more intelligent studies of their markets, and they must give more attention to matters such as production programs and schedules, improvements in manufacturing processes, reductions in manufacturing costs, the carrying of proper stocks, and related problems. They will then be in a position to talk price as well as quality in their competition with other hollow masonry materials.

It is true that manufacturers of hollow concrete building units are now selling their product on a quality basis, in the face of lower prices for other materials; but under such conditions there is an enormous sales resistance to overcome. This resistance can be removed if the cost of production can be equalized with that of competing materials.

Contractors who expect to remain in business will do well to establish new unit costs at levels below those of 1928 and 1929. To do this they must lower their construction costs by means other than wage reductions. As one possibility, for illustration, they should know their actual form work costs, so they will know whether to continue doing their own form work or whether to sublet it to companies that specialize in the erection and removal of metal forms or other special types. They must handle cement and aggregates more economically, they must learn the art of controlling the strength of concrete, and they must find more economical methods of mixing and distributing concrete.

The outlook is good for contractors and products manufacturers who enjoy facing new conditions and devising ways to meet them. They will accept the belief that the era of price boosting is ended. They will take a tip from the automobile industry and will set to work on the job of trimming their unit production costs. Those who are slow to accept the new order of things, and unwilling to exert themselves, will gain their own reward.

Concrete Aqueduct Irrigates Half Million Acres

Great Structure Is Two Miles Long—Main Feature in Canadian Pacific Railway Irrigation Project—Inverted Siphon of Concrete Carries Water Under Railway Tracks

By GEORGE P. FRENCH

A FEW years ago the engineering staff of the Canadian Pacific Railway was confronted with a puzzling problem in connection with the proposed C. P. R. irrigation scheme in the neighborhood of Brooks, Alberta. The C. P. R. had erected a dam 720 ft. wide across the Bow River, west of Brooks, which afforded them a fine head of water fifty feet higher than the level of the surrounding country. By means of a system of judiciously placed channels, this water was to be supplied to the farms in the district, as a dependable source of moisture. In previous years crops in the Brooks area, which early in the season had given promise of good yields, had almost invariably failed to flourish, due to lack of rain.

Two-Mile Aqueduct Across Ancient Stream Bed

But here was the problem. Cutting through the center of the half-million-acre irrigable area was an ancient, dried-up river bottom, some fifty feet in depth and approximately two miles in width. The question was how to get a sizable stream of water across the valley to the plain on the other side.

The construction of a reinforced concrete aqueduct solved the difficulty. The aqueduct consists of a two-mile concrete flume, in basin form, twenty feet wide by ten feet deep. The flume is borne by steel-and-concrete trestles, varying in height with the contour of the valley floor, to a maximum of fifty feet.

Inverted Siphon of Concrete

A minor difficulty cropped up in the design and construction of the aqueduct, at a point half way across the valley, where a "detour" had to be planned to avoid the railway line. It was thought the wiser plan to tunnel beneath the tracks, and to pass the water through a large reinforced concrete pressure pipeline, which rose on the far side of the tracks to rejoin the aqueduct. This arrangement was successfully carried out.



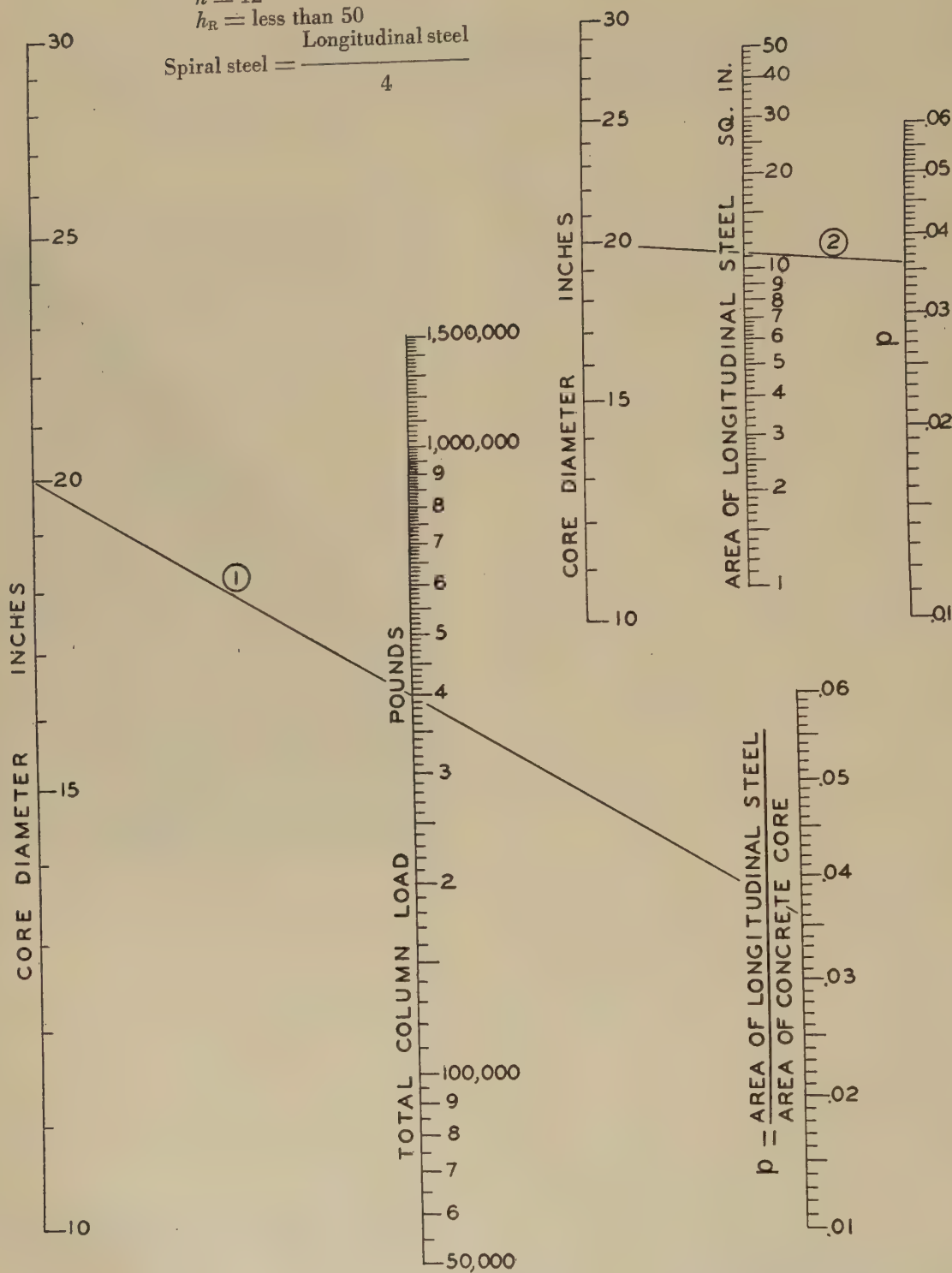
Brooks aqueduct, two miles long, consists of a reinforced concrete flume on a trestle of the same material

As a direct result of the Brooks irrigation scheme, farmers of that district are today reporting crop increases varying from 75 per cent to 130 per cent greater than the yields under the old conditions.



Large inverted siphon of reinforced concrete that carries water under railway tracks is a novel feature of the Brooks aqueduct

Chart M₁ (2,500; 10)
Spiral Reinforced Columns
 $f'_c = 2500$ lbs. per sq. in.
 $n = 12$
 $h_R = \text{less than } 50$
 Spiral steel = $\frac{\text{Longitudinal steel}}{4}$



Reinforced Concrete Design Simplified

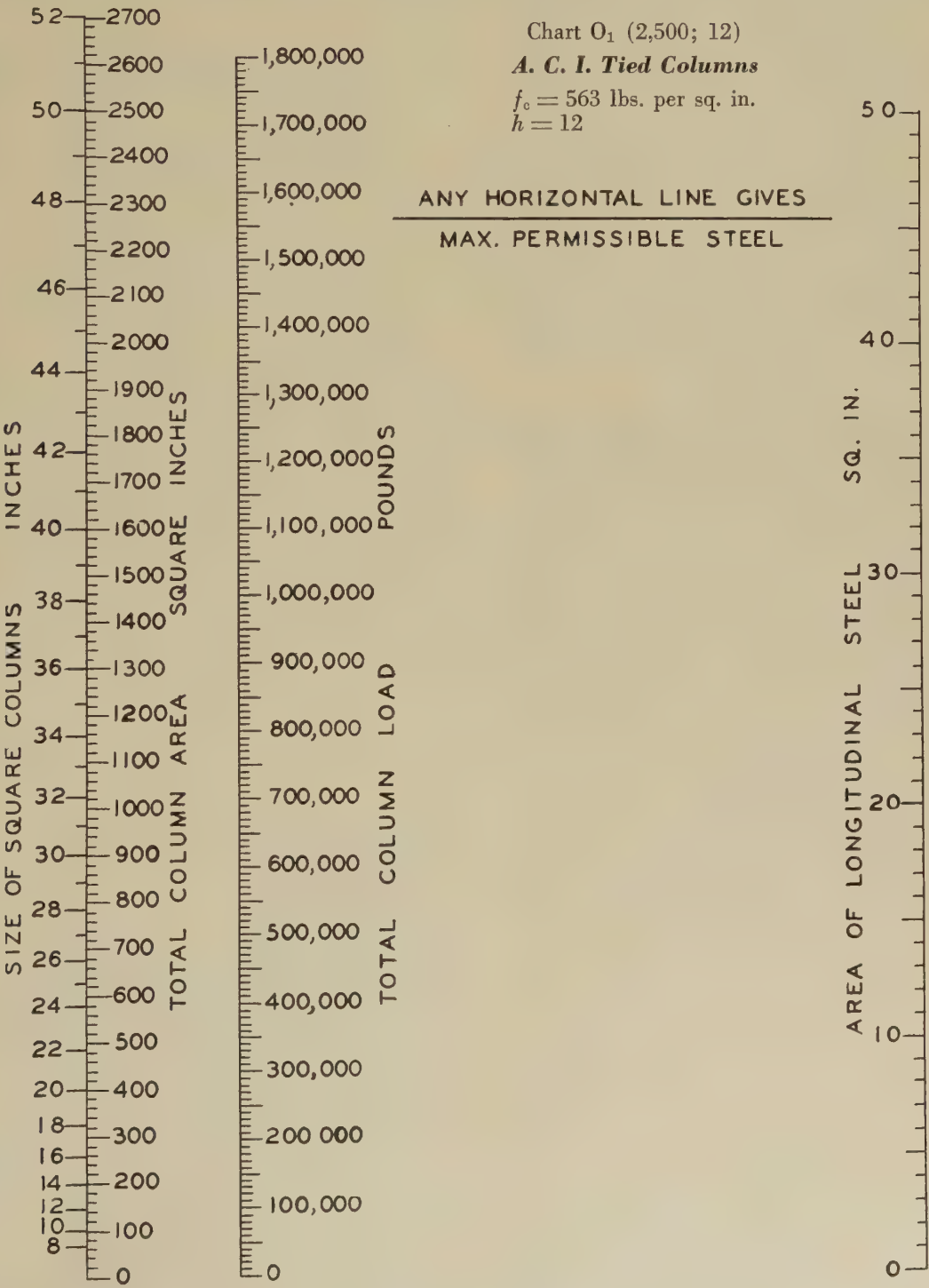
By JAMES R. GRIFFITH

Professor of Structural Engineering, Oregon State Agricultural College

THE accompanying two charts presented below and on the preceding page need no explanation for the reader who has followed the series. Chart M₁ (2500; 12) may be used under either the Joint Committee specifications or the A. C. I. Code. Attention is called to the fact, however,

that Chart O₁ (2500; 12) is applicable to only the A. C. I. Code due to the higher working stress allowed.

These two charts complete the series. There are now available charts for beams, slabs, and columns covering 2,000, 2,500, and 3,000 lb. concrete.



HOW TO DO IT

♦ Questions and Answers ♦
Consultation and Comment

A department devoted to the solution of problems encountered in concrete work. Readers are welcome to add to or improve upon the suggestions printed and to submit their views for possible publication.

Concrete Laundry Trays

Where can I get molds for the manufacture of concrete laundry trays, and what mixtures of concrete are commonly used in their manufacture? Any additional points on which you can give me information will be appreciated.—E. L. H., Tulsa, Okla.

Molds for casting concrete laundry trays may be obtained from several manufacturers. A list is being sent.

Concrete laundry trays are commonly made by a process under which the fresh mixture is mechanically vibrated. Several successful manufacturers use a mixture of 1 part of cement to 3 parts of sand that is well graded from fine particles to the $\frac{1}{4}$ -inch size. The consistency of the mixture is sufficiently plastic to produce a smooth finish. This small size of aggregate is necessary because of the thin walls of the product; and the walls, in addition to being thin, are quite heavily reinforced with steel wire cloth of $\frac{1}{2}$ -inch mesh.

All corners are protected by metal rims to prevent chipping, especially while the trays are being transported or installed. The product is made in single, double or triple basins with or without backs.

It might be well for you to get into touch with J. C. Harper, president, Concrete Laundry Tray Institute, 3126 South Canal Street, Chicago, Illinois.

Repair of Leaky Basement Walls

The September (1930) issue of CONCRETE, in the How-To-Do-It department on page 44, prints a question from a reader concerning the repair of a leaky basement wall, and a recommendation for correcting the defect by the application of a waterproofing coat of cement plaster to the outside of the wall.

While the method recommended would probably stop the leakage, we usually recommend a method that is more economical, and from experience we know it is generally satisfactory. This method consists of the application of two coats of Super cement and sand mortar to the inside face of the wall, in the vicinity where the leakage has developed. Any disintegrated concrete must first be removed, and the surface to which the mortar is to be applied must be thoroughly cleaned. If water is coming through the joint between the floor and the wall, we recommend cutting out a narrow strip of the floor next to the wall and refilling it with mortar.—R. S. Ridge, Super Cement Division, Lawrence Portland Cement Co., Philadelphia, Pa.

The method described by Mr. Ridge will undoubtedly cure the trouble in many instances, since the nature of the leakage is often favorable to that method of treatment. Even though the existing leakage can usually be stopped by the application of coats of cement mortar to the inside

face of the wall, the possibility of future trouble in other parts of the basement may be avoided by placing drains around the building. This will remove the primary cause of the trouble.

Shrinkage of Concrete Masonry

We are having difficulties with what appear to be shrinkage cracks in some walls in which our concrete blocks are used. In some cases these cracks develop shortly after the walls are laid up, although in most cases no cracks develop at all.

Of course we have our trouble with the walls that do crack, and not with those that don't. Can you give us any idea as to how this cracking might be avoided?—R. W. S., Long Island City, N. Y.

It has long been suspected, and now quite conclusively proved by tests conducted by the Portland Cement Association, that the kind of shrinkage cracks you describe are caused by laying up the walls while the blocks are too green.

The tests to which reference has just been made are described in detail in the April (1930) Journal of the American Concrete Institute, pages 699-716. They show that concrete masonry units cured under ordinary methods (48 hours in a moist room, then stored in the open air), shrink quite perceptibly until they are about 26 to 30 days old. After that age the units expand or shrink with changes in atmospheric conditions, in a manner similar to all masonry materials, but not in sufficient amount to be harmful.

It is quite certain that your difficulties have occurred in cases where the units were delivered and laid up in the wall too soon after their manufacture.

Checking of Floors

What causes fine surface checking on floors and how can it be corrected?—G. A. D., Chicago, Ill.

The durability and effectiveness of a floor finish depends primarily upon the observance of the fundamental rules for making, placing, finishing and curing concrete. To prevent surface checking, it is necessary to observe the following directions for finishing and curing:

After striking off the wearing course to the established grade, it shall be compacted with a wood float. Floating shall be followed by steel troweling after the concrete has hardened sufficiently to prevent excess fine material from working to the surface. Dry cement or a mixture of dry cement and sand shall not be sprinkled directly on the surface of the wearing course to absorb moisture or to stiffen the mix. As soon as the concrete has hardened to prevent damage thereby, it shall be covered with at least 1 in. of wet sand or other satisfactory covering and shall be kept continually wet by sprinkling with water for at least 10 days.

Concrete for the Builder

A Department Devoted to the Promotion and
Practical Construction Details of Concrete Work

Pedestrian Subways Increase Business and Promote Safety

Large Volume of High-Grade Concrete Construction Involved—
Some Cities Finance Complete Program With Bond Issues—How
Public Sentiment for Pedestrian Subways May be Developed

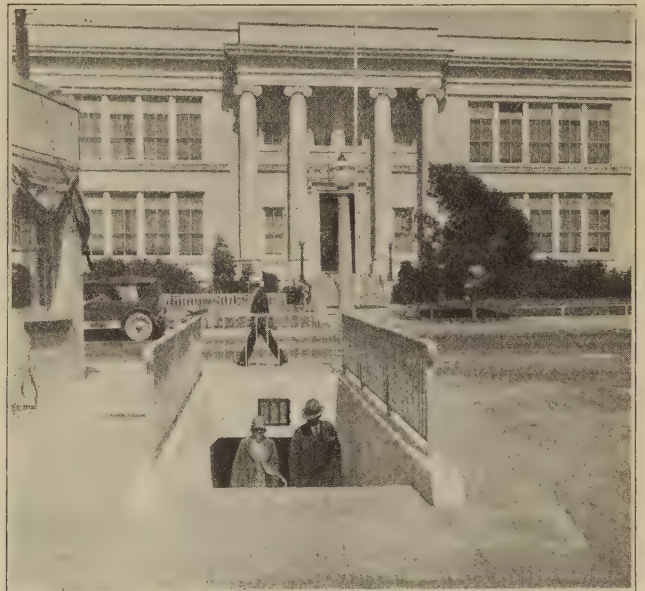
A NEW market for concrete, which aggressive concrete contractors are taking advantage of, is now being developed—the construction of pedestrian subways. This market is developing because approximately 70 per cent of all traffic fatalities result from motor vehicles hitting pedestrians, making it necessary to protect pedestrians by providing them with safe means of crossing streets.

Pedestrian subways beneath busy thoroughfares are without doubt the best means of solving the street crossing problem. They protect the motorist and pedestrian alike by making it unnecessary for their paths to cross. They speed up motor traffic and reduce and often eliminate the need of police supervision at busy intersections. Along with highway grade separations, wide one-way streets and double decking, the pedestrian subway is taking its place as an effective and permanent solution of tangled traffic problems. And the pedestrian subway market is a concrete market.

Where Pedestrian Subways Are Most Needed

The most urgent need for subways at present is around

school grounds, for there is little doubt that a large percentage of the motor-pedestrian accidents involve children. In practically every town of 5,000 or more there are one or more busy thoroughfares which school children must cross and under which subways are needed. Contractors,



A Los Angeles subway built with bond-issue funds

One of 40 pedestrian subways built at Los Angeles. This one is located at Western avenue and Browning boulevard, directly in front of the Santa Barbara grade school



An experimental subway built at Highland Park, Mich.

This pedestrian subway is located at Second and Cortland avenues. It was built in 1924, as an experiment, to serve a large number of school children that had to cross this busy intersection

therefore, are finding this the best field to develop at the present time.

Promotion of this business consists of selling city officials on the need for pedestrian subways near schools. In the majority of cases this is best done by contacting the residents of the sections in which the subways are needed, and by having petitions signed for presentation to the city council. Accident data, which can be secured from the National Safety Council, photographs and descriptions of successful pedestrian tunnels, together with local side-lights, pointing to the need for pedestrian protection, will

use of the tunnel very faithfully, . . .

"There are still fourteen intersections at which police officers are placed to safeguard school children crossing main thoroughfares. Formerly a regular policeman was stationed at each of these intersections, practically all of his time being taken up in this service. The city now employs special policemen to do this work and they are paid at the rate of \$100 a month, thus cutting the cost of patrolling these crossings approximately 50 per cent. The tunnels can, however, still be justified from an economic standpoint as well as from the standpoint of greater safety to the children. In addition, tunnels furnish a safe means of crossing the street for children and the general public 24 hours of the day instead of for a few limited hours during which an officer is stationed at the intersection."

That this subway was a success is evidenced by the fact



A subway built simultaneously with a boulevard
This subway under Washington boulevard, River Forest, Ill., was built to serve children attending the nearby school. The cost was approximately \$5000

that Highland Park has since voted a bond issue for the construction of additional tunnels.

How a Pedestrian Subway Was Promoted

The village of River Forest, Illinois, a suburb of Chicago, recently completed a tunnel under Washington boulevard to serve school children attending the Washington school. Washington boulevard is a heavily traveled east and west highway into Chicago. In 1929 a contract was to be let for the concrete paving of this highway through River Forest. Many River Forest residents, whose children attended the school, felt that the new pavement would bring more traffic and would increase the possibilities of accidents. D. B. Harper, of the firm L. L. Harper and Son, consulting engineers at River Forest, conceived the idea of building a tunnel in front of the school at the same time the paving was done. He easily secured the support of other River Forest citizens in his neighborhood, and presented his plan to the city. It was readily accepted, and the tunnel was built. The accompanying photograph and drawings of this tunnel may be used by contractors in promoting pedestrian tunnels. The tunnel cost \$5,000 to build, including the installation of a lighting system and drainage equipment. The tunnel has proved to be very successful, although it has been in service only a few months. In fact, many residents of River Forest believe that this subway is one of the best improvements ever built in the village.

The design and construction of pedestrian subways varies considerably. Where a street can be torn up and

traffic detoured long enough to allow the tunnel to be built, or where the tunnel is erected in connection with a new pavement, construction is not difficult. When the tunnel must be built without interrupting street traffic, a more difficult problem presents itself. In most instances working drawings and specifications will be furnished from the city engineer's office. If not, it is advisable to obtain the services of an experienced engineer.

The pedestrian tunnels that have been built in several parts of the country serve to indicate the value of this means of pedestrian protection in congested areas. There is little doubt that within the next few years such structures will be considered as important aids to traffic control as are wide highways, grade separations and one-way streets today. Progressive concrete contractors are now working to get their share of this new concrete market.

How Seven Miles of Sidewalks Were Promoted in Elgin, Texas

This is the story of how seven miles of concrete sidewalk were promoted in Elgin, Texas.

City officials were consulted to determine the status of the sidewalk ordinance and the extent to which it was being enforced. Endorsement of sidewalk promotion by the mayor and the city commissioners was then obtained before opening a publicity campaign. Support of the city officials also was secured in a movement to promote building of cross-walks and curb approaches.

A survey of Elgin showed that only about 60 per cent of the school enrollment was served by uninterrupted sidewalks between pupils' homes and schools. The health officer volunteered the information that he could trace 90 per cent of the sickness of school children during the winter to wet feet caused by going to school over wet, muddy, disconnected sidewalks.

The approval of the city officials and the survey results were then presented to a newspaper editor to whom the proposed sidewalk campaign had an exceptional appeal. The newspaper opened a vigorous campaign with editorials and interviews with the mayor and the health officer. The president of the Parent-Teachers' Association and the Rotary Club were called into the editor's office to review the program. Meetings of both organizations were held and petitions were handed to parents, teachers and Rotarians for distribution. Each person was instructed to make a petition to be signed by home owners in his neighborhood who did not have and who needed concrete walks. Local concrete contractors were also given petitions. A race soon developed between the Parent-Teachers' Association and the Rotary Club to see which could obtain the larger number of signers.

At the end of the campaign petitions had been signed for two and one-half miles of concrete walk with the necessary cross-walks, the entire campaign requiring less than two days' effort. Campaigns for three other sidewalk projects were then started, netting petitions for a total of seven miles of sidewalk.

This entire project is an excellent example of what results from a properly organized program for selling concrete improvements to the people who will benefit from them. In this case approximately 185,000 sq. ft. of sidewalk were promoted, representing a large amount of work for contractors.

Concrete Basement Walls

Watertight concrete basement walls should be made thicker than the wall of the structure they support. The ledge thus formed by the change in wall thickness provides a firm shoulder for the first floor.

Approved Methods for Cleaning Terrazzo Floors

Terrazzo floors given proper care will retain their beauty and sheen indefinitely. However, regular and careful cleaning is necessary to prevent dirt and grit from accumulating on the surface of terrazzo. The grinding wear which service puts on terrazzo covered with dirt and grit causes irreparable damage to the highly polished surface.

Such damage is likely to be severe in hotel lobbies, in hallways of public buildings and in office buildings unless the terrazzo is cleaned regularly in an approved manner. Where floors are neglected, it often becomes necessary, eventually, to regrind and polish them in order to restore the original finish. Regular cleaning, then, is a certain economy in that it eliminates repair costs.

The research department of the Chicago Terrazzo and Mosaic Contractors' association recently published a pamphlet, "Care and Treatment of Terrazzo," which contains valuable recommendations resulting from a study of the problem. The subject is of such importance that builders may want to pass the information on to their clients for whom they have built terrazzo floors. The following is quoted from the pamphlet:

"To properly care for new terrazzo floors and bases they should be scrubbed two or three days a week and mopped on alternate days and should be rinsed after scrubbing or mopping. Never use soaps or powders containing alkali, acids, or other strong compounds, as they injure terrazzo and ruin the floor.

"A new terrazzo floor properly completed is left to a hone finish and it will require from six to twelve weeks before a sheen is noticeable. The sheen seen on old terrazzo floors is not an artificial polish but is produced by proper care and age. Such a sheen will not cause a floor to be slippery and is permanent. To get this desired sheen on a terrazzo floor, use heavy lather of suds from any pure soft washing soap.

"When the terrazzo floor is finished and other trades in the building have considerable work to do, the floor being the most abused part of any structure, there accumulates dirt and grit which is not so easily removed. When a floor is in this condition, a cleaning compound containing an abrasive is recommended. The soap or powder should be sprinkled over the floor and scrubbed. If poured in the scrubbing water, the abrasive grit will settle on the bottom of the container and the desired result will be lost. Use the compound until your floor is thoroughly cleaned. Then use the soft soaps as stated above to produce a permanent sheen."

Care of Concrete Swimming Pools in Winter

So that he may be able to answer inquiries on the proper care of concrete swimming pools during freezing weather, the concrete builder should digest the suggestions of a number of pool owners in northern states and Canada.

They indicate that in most instances, swimming pools are drained at the beginning of winter and allowed to remain empty until spring. However, if good drainage of the surrounding soil has not been provided for, frost action on an empty pool is likely to cause an upheaval of the floor slab. Protection in such a case may be obtained by spreading a 6 or 8 in. layer of straw over the floor, scattering a few loose boards around to hold it in place. This is quite common practice.

There are many examples of pools that have been allowed to freeze over for ice skating. When it is known at the time of construction that a structure will have this service, every effort should be made to get as good a concrete job as possible. It should be pointed out that with a water-cement ratio of $5\frac{1}{2}$ or 6 gallons of water per sack of cement, the resulting concrete will be hard, dense and free from the minute holes and pores such as occur when a greater water-cement ratio is used. It is the frost action in these pores—alternate freezing and thawing in the presence of moisture—that is the direct cause of progressive disintegration of exposed structures. Recommendations for extreme or severe exposure as given below should be followed for all swimming pools.

Table I may be used as a guide in selecting the water-cement ratio where the conditions of exposure require a higher class of concrete than necessary to meet the strength requirements. A number of types of structures is given in each group as suggestive; the exact classification in individual cases or of other types will depend upon the conditions of exposure at the particular site. The classification given is based on conditions prevailing in the greater part of the United States and assumes proper workability of the mixture, thorough mixing, placing the concrete by puddling to completely fill the form and incorporate the reinforcement, and thorough protection from drying out or low temperature during the early hardening period.

In proportioning concrete for exposure, the water-cement ratios recommended in this table often result in concrete strengths that seem unnecessarily high. In order to assure concrete of the quality required to withstand the conditions of exposure, these water-cement ratios should not be exceeded. Perhaps the chief cause of unsatisfactory concrete in the past has been a tendency to rely on strength requirements alone in proportioning concrete for structures subjected to water pressure or severe weathering.

TABLE I
Classes of Concrete for Different Degrees of Exposure

Type of Structure	Degree of Exposure	U. S. Gal. of Water* per Sack of Cement
Walls, dams, piers and other structures exposed to sea or alkali waters.	Extreme	$5\frac{1}{2}$
Walls, dams, piers, reservoir linings, etc., exposed to alternate wetting and drying in fresh water in northern climate. Watertight structures. Sewers, pressure pipe, tanks, piles, athletic stadiums, pavements, all thin structural members exposed to severe weather and frost action.	Severe	6
Walls, dams, piers, reservoir lining exposed to fresh water in southern climate. Exterior columns and beams of reinforced concrete buildings. Basement walls. Thin structural members of all types exposed to moderate weather and frost action.	Moderate	$6\frac{3}{4}$
Ordinary enclosed structural members. Heavy piers and retaining walls in moderate exposure. Pavement bases. Mass concrete, footings, etc., protected from alternate wetting and drying and from severe weather conditions.	Protected	$7\frac{1}{2}$

*These quantities should not be exceeded even when resulting strength is higher than required for structural stability. Free water or moisture carried by the aggregate must be included as part of mixing water.

When used as a skating rink the water level in the pool should be maintained six inches to one foot below the scum gutter to prevent any possible damage to the gutter.

When there is any question about protecting the pool through the winter, it is advisable to have it be drained, and the floor protected as already described.

Quality and Color Being Built Into Detroit's Gasoline Stations

Color and Appearance Become Factors in Competition Between Oil Companies—Distinctive Architecture and Color Schemes—Concrete Units, Cement Stucco and Concrete Roofing Tile Are Materials Employed—One Contractor Builds Twenty Stations

By WILLIAM J. SHORTELL

General Contractor, Detroit, Mich.

WITH the number of gasoline stations in the Detroit area increasing at a rapid rate, and with competition becoming keener among oil companies, the selection and development of a gasoline station site now requires something more than the selection of a central or popular location. The public's demand for color and architectural attractiveness has made it necessary that gasoline stations be built with a view to attracting the attention of the motorist, making the stations carrying various brands easily distinguishable by general appearance and color.

Standardize on Color and Architecture

Realizing this, a number of leading oil companies operating in this district are standardizing the design of their service buildings as much as possible, using standard color combinations, and, as nearly as practicable, one type of architecture.

Portland cement stucco, colored concrete roofing tile and integral coloring in concrete have found great favor, particularly with three of the leading oil companies.



One of Texas Company gasoline stations in Detroit

These companies, having selected standard color combinations and types of design, are utilizing the various colors to be obtained in cement and concrete products, to give a desired color effect and uniformity of appearance in all their stations. In these companies' buildings the stucco is applied either on stone concrete or cinder concrete blocks. When the walls are to be white, white cement is used; or if another color is desired, the walls are painted with a stucco paint. When a contrasting color is needed to complete the color combination, colored concrete roofing tile are used. In many cases the driveways have been laid with an integral coloring, either to match the color of the building or to complete a color effect.

Recently the Texas Oil Company completed a super-service station here, which is typical of the latest development in the use of color to obtain uniformity of appearance in service stations. The walls of this station are of 12-in. concrete block with portland cement stucco exterior.



Another type of service station

The stucco was applied in three coats, the total thickness being $\frac{7}{8}$ -in. The finish coat is of white cement and silica sand, with a burlap finish. Pea-green concrete roofing tile were used to complete the color combination, laid in a manner suggesting Spanish architecture. The floors of the building were laid with tile-red integral coloring in the concrete. The general appearance is green and white, with some red apparent to blend with the color of the equipment.

This type of construction, in addition to meeting the public's demand for color, has the added feature of permanence, fireproofness and economy. Of the twenty similar stations built by the writer in the past few years, not one has ever needed repairs to the stucco, roofing tile or concrete work. In fact, a ten-year guarantee is given on the concrete roofing.

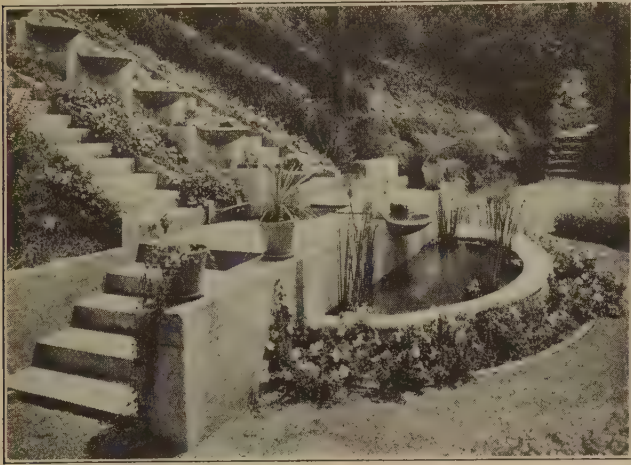
Independent Stations Conform

Many of the independent gasoline station owners are building their stations similar in design to the company-owned stations, to take advantage of the advertising value of uniformity in appearance of all stations handling one product.

With a great variety of colors and finishes obtainable in portland cement stucco, the wide color range offered in concrete roofing tile, and almost any color desired easily obtained by the use of integral coloring in concrete, we may expect to see this type of construction become even more popular in the next few years.

Valuable Book for Concrete Builders Contains Many Illustrations

An attractive 20-page book 8½ by 11 inches in size and containing 64 illustrations, has been issued by the Portland Cement Association under the title of "Permanent Improvements for Homes, Schools, Parks, Playgrounds and Industrial Plants."



One of the many illustrations in the new publication

The first section of the book deals with improvements built of concrete around the home. Another section describes and illustrates the use of concrete construction in increasing both the usefulness and the appearance of



Another of the illustrations contained in the builders' book

school grounds. The third section deals in similar fashion with parks and playgrounds, and the final section emphasizes the practical utility of concrete floors, driveways, platforms and related improvements around industrial plants.

Concrete builders will obtain many useful suggestions from this publication, and they will find it helpful in gaining the interest of prospective customers.

Helping Customers See the Finished Job Gets More Business For Contractor

It is only natural that contractors who are giving their business the benefit of sales effort for the first time will find themselves confronted with new problems. When Jess Ebert, an aggressive contractor in Iola, Kansas, started selling his services, he discovered he had to learn a few tricks about selling.

He recently built a foundation wall, sidewalks and driveways for a home owner who had moved his house to a new location. The house was completely remodeled after moving, and the owner mentioned to Ebert that he would like to add something to the rear yard which would improve its appearance.

With the aid of literature and attractive pictures, Ebert was able to show his prospective customer pools, flagstone walks and concrete benches which would greatly improve the appearance of the yard. Although the owner was interested and appeared to be an excellent prospect for additional concrete work, the contractor found that for some reason he could not close the deal.

Ebert, almost at a loss to know what to do next, went to see an engineer friend who happened to be one of his neighbors. He told the engineer his troubles. "I am up against it," he said. "I want you to help me. I have a man down on South Elm Street who wants to build a fish pond and beautify his backyard. I showed him some good pictures, but he doesn't seem to be sure it will look right."

The engineer saw the situation confronting the contractor and offered his assistance. He went with Ebert to call on the owner and suggested that the proposed improvements be laid out on the ground. This idea made an impression on the owner, and the three staked out a small, attractive pool, located a bird bath and some flagstone sidewalks. Then a concrete curb was located across one end of the lot and, before they were through, the owner had assisted in locating some additional walks and a concrete incinerator.

The "laying out" process had increased the owner's interest. He was able to see how these various improvements would look in his yard. It gave him a mental picture which made him decide to go ahead with the work; not only with the improvements originally planned, but more, too.

By this small amount of sales effort, Ebert doubled the amount of concrete work which he originally had. This proved to be a good lesson in salesmanship for him and he has become an enthusiastic salesman of his own business.

Concrete Foundations for Chimneys

Good chimneys, whether located on the interior or exterior of the building, should always rest on solid concrete footings extending well below the maximum frost penetration and of sufficient width and thickness to carry the weight of the chimney without danger of settlement.

Grooved Concrete Approach

A concrete approach to raised driveways for heavy teaming or trucking will provide secure footing if the surface is grooved either with a trowel or by pressing triangular strips into the fresh concrete. If heavy loads are carried the slab should be at least eight inches thick.

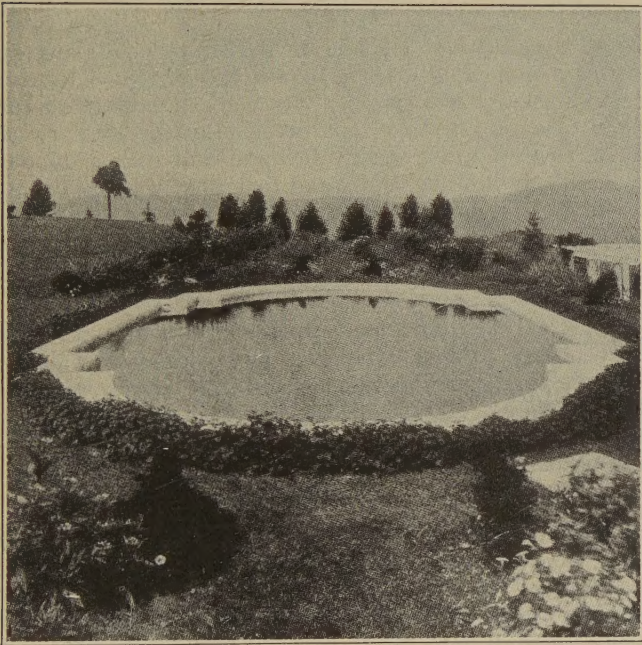
Contractor's Merchandising Method Wins Business

Eastern Contracting Concern Develops Concrete Work in Parks and Private Estates — Smaller Home Owner Not Overlooked — Well-Illustrated Book Great Aid in Winning Contracts

THE contracting firm of Gribben-Rawlings, Inc., of Scarsdale, N. Y., developed considerable concrete construction business in the so-called dull times of 1930. They obtained this business largely through the sale of concrete work around the most pretentious homes, estates and parks. Swimming pools constituted their main sales effort.

Well Illustrated Book Helps Sales

Realizing that it is best to show what a swimming pool or other concrete improvement will look like when com-



One of the illustrations in "The Book of Swimming Pools"

pleted, the contracting company issued a 16-page booklet containing numerous illustrations. They used "The Book of Swimming Pools" in a well-planned selling campaign in which salesmen made personal calls on many prospects for concrete improvements. A booklet like this is helpful because pictures tell the story much better than it can be told in words. Each page of the book contains a picture of an exceptionally attractive pool, accompanied by a short description and sales talk set in large and attractive type.

Dealing with Home Owners Direct

Gribben-Rawlings are getting a large share of the concrete work around homes by calling on home owners who can buy concrete improvements. These need not be the wealthy property owners alone. The home owner who takes pride in the modest yard where his children play is as good a prospect as the man who maintains an elaborate estate. Neither should be overlooked.

Landscape Architects and Park Officials

Probably the best way to get business from estates and parks is to work with landscape architects and the public officials in charge of parks. Gribben-Rawlings are doing this. Many landscape architects do their own concrete work, not by preference, but because no experienced concrete contractor has ever proved that he can do this work better than they can do it themselves. Frequently, this is true also of those in charge of parks. It has been possible, then, for Gribben-Rawlings to obtain contracts from these sources because of the excellent concrete work of similar character which they have built. Under this new order of things, better concrete is produced and the landscape architects or park superintendents have more time for their other duties.

The Gribben-Rawlings contractors have gone direct to those who can buy concrete improvements of all kinds and have convinced them that such work can be made attractive at reasonable cost.

Testing for Organic Matter in Sand

In sections of the country where pine, oak, and tamarack grow plentifully, sand deposits may become laden with decaying humus. Leaves, bark, sawdust and other vegetation which form tannic acid upon decomposing get into the sand, and, as a consequence, impair its value for use in making concrete.

It is a simple matter to find out whether sand has been so affected. An ordinary 12-ounce prescription bottle which can be obtained at a drug store is filled to the 4½-ounce mark with a sample of the sand. To this is added a three per cent solution of caustic soda to the 7-ounce mark. The solution is made by dissolving one ounce of sodium hydroxide in a quart of distilled water. Care should be taken not to get any of this solution on the hands or on clothing, as it may cause serious burns.

After the solution has been added to the sand, the bottle is corked and thoroughly shaken. It is then allowed to stand for 24 hours.

If, at the end of this time, the liquid is clear, the sand is free from organic matters. A straw colored liquid indicates the presence of some organic matters, but not enough to impair the quality of the concrete. A dark colored solution means that the sand contains injurious amounts. It should not be used in concrete until it has been first washed and retested.

Concrete Footings

Concrete footings should always be placed in firm soil. In general, a soil of soft clay will support one ton per square foot; wet sand or firm clay, two tons; fine and hard sand, three tons; hard, dry clay or coarse sand, four tons; and gravel, six tons.

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit, Michigan.
Annual convention, Feb. 24-26, Hotel Schroeder, Milwaukee, Wis.

American Concrete Pipe Association; M. W. Loving, Secretary, 33 W. Grand Ave., Chicago.

American Road Builders' Association; Chas. Upham, Engineer-Director, 914 National Press Building, Washington, D. C.

American Society of Civil Engineers; Geo. T. Seabury, Secretary, 33 W. Thirty-ninth St., New York City.

American Society for Testing Materials; C. L. Warwick, Secretary-Treasurer, 1315 Spruce St., Philadelphia, Pa.

Associated General Contractors of America; E. J. Harding, Assistant General Manager, 1150 Munsey Bldg., Washington, D. C.

Cast Stone Institute; L. A. Falco, Secretary, Chapel St. and Blatchley Ave., New Haven, Conn.

Building Officials Conference of America; Col. John W. Oehmann, Secretary, 1253 Lawrence St., N. E., Washington, D. C.

Cement Institute; Luther G. McConnell, General Manager, 11 East 44th St., New York City.

Concrete Masonry Association; Jack Franklin, Secretary, 7071 Plankinton Bldg., Milwaukee, Wisconsin.
Annual convention, Feb. 23-26, Hotel Schroeder, Milwaukee, Wis.

Concrete Reinforcing Steel Institute; M. A. Beeman, Secretary, Tribune Tower, Chicago.

Haydite Manufacturers' Association; Dan F. Servey, Secretary-Treasurer, 203 Mutual Building, Kansas City, Mo.

Joint Committee on Standard Specifications for Concrete and Reinforced Concrete; F. R. McMillan, Secretary, 33 W. Grand Ave., Chicago.

National Association of Paris Transit Mixed Concrete Manufacturers; Chas. P. Maloney, Secretary, E. Water and E. Salmon Streets, Portland, Oregon.
Annual convention, Jan. 9-12, St. Louis, Mo.

National Board of Fire Underwriters; W. E. Mallalieu, General Manager, 85 John St., New York City.

National Concrete Burial Vault Association; J. H. Stuart, Secretary-Treasurer, Bremen, Ohio.

National Crushed Stone Association; J. R. Boyd, Secretary, 751 Earle Building, Washington, D. C.
Fourteenth annual convention, January 19-22, St. Louis, Mo.

National Fire Protection Association; Franklin H. Wentworth, Secretary, 40 Central St., Boston, Mass.

National Lime Association; Norman G. Hough, Secretary and Manager, 927 Fifteenth St., N. W., Washington, D. C.

National Ready-Mixed Concrete Association; Headquarters, 27 Barbeau Street, Pittsburgh, Pa.
Annual convention, Jan. 26, Hotel Jefferson, St. Louis, Mo.

National Sand and Gravel Association; V. P. Ahearn, Executive Secretary, 432 Munsey Building, Washington, D. C.

National Slag Association; H. J. Love, Secretary-Treasurer, 937 Leader Building, Cleveland, Ohio.

Northwest Concrete Products Association; W. P. Hews, Secretary-Treasurer, Yakima, Wash.

Portland Cement Association; William M. Kinney, General Manager, 33 W. Grand Ave., Chicago.

Rail Steel Bar Association; H. P. Bigler, Engineering Secretary, Builders' Building, 228 N. La Salle St., Chicago, Ill.

Wisconsin Concrete Products Association; Jack Franklin, Secretary-Treasurer, 425 East Water St., Milwaukee, Wisconsin.
Annual convention, February 23-26, Hotel Schroeder, Milwaukee.

The Concrete Industry —25 YEARS AGO

THE early history of reinforcement of concrete, back to Monier, the later developments in such systems, and the design of highways and bridges, are topics covered in an article by Louis Chevalier, in the December, 1905, issue of CONCRETE.

DAVID N. HARPER, on the editor's page, voices his opinion that, "There need be no fear that with proper publicity given to the advantages of true portland cement as a building material the demand will not be equal to the increased output. In reference to the use of cement in this country it ought to be said that a great deal is yet to be learned.

"We doubt whether one-tenth of the material (concrete) which has thus far been manufactured in this country would equal in compressive resistance the requirements of the New York code of three thousand pounds to the square inch.

"At a meeting of machine manufacturers not long ago it was proposed to draft standard specifications for concrete blocks on the basis of one part of cement to four parts of aggregate. We took occasion at that time to call attention to the fact that we believed that such a standard was entirely impracticable, and that what was needed was a standard of quality. This brought forward the suggestion that they perhaps knew enough to run their own business."

SOMETHING of various structures built of concrete including bridges, viaducts, and bulkhead walls, at Philadelphia, Pennsylvania, is told in a lengthy article in the December, 1905, issue of *The Cement Age*. Dimensions, proportions, and some construction details are given about each structure.

HERALDED as a "peculiar feat of engineering," the construction and tipping of a concrete dam into place is described by Wm. S. Humbert, as follows: "A concrete column rising to a height of 70 feet, was successfully overturned to fall into the river in order to raise the water at the intake from which the City of Niagara Falls and the Niagara Falls Park and River Railway both take water."

Upon a wooden trestle 20 feet high was built a column 50 feet high and 7 feet, 4 inches square, composed of concrete made of one part of cement to three parts of sand and five parts of stone. At intervals of 8 feet in its height wooden wedges were inserted 12 inches wide at the outside and tapering to a width of 6 inches. Through the center of the column an 800-pound chain was run in order to hold the six parts intact after they were in position.

"To overturn this structure, the tipping timbers were raised six inches by means of jacks at the bottom of the trestle until the top of the column was thrown about three feet out of plumb. The wooden trestle fell with the column, as planned. The column struck the water in an almost horizontal position. The dowels separated, as expected, but two of the concrete sections were broken by submerged rocks."

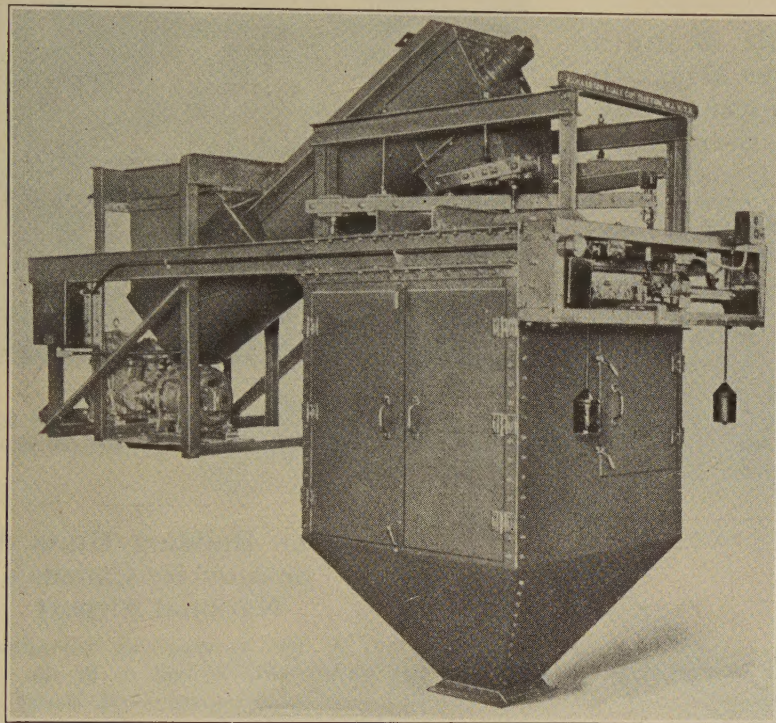
New Equipment and Materials

New System Designed for Accurate, Fast Cement Weighing

Bulk cement can now be weighed fast, accurately, and automatically, according to the Richardson Scale Company, Clifton, N. J. For this purpose it has designed

the scale weighing hopper.

The scale is of standard construction with hanging weights for part of the load and a weigh beam with sliding weight for the remainder at one end of the system and the weight hopper for the cement is suspended at four points at the other



the Richardson automatic weighing system, available in either the weighing hopper or weighing conveyor type.

Flooding is said to be eliminated by the double screw feeder, comprising one large and one small conveyor. The large conveyor feeds the main part of each weighing and is inclined at a considerable angle to take the "run" out of the cement and deliver it quietly and under control through a dust-proof chute into the weighing hopper, which is also enclosed in a dust-proof housing having suitable access doors.

When the main screw feeder has delivered approximately 90 per cent of the individual weighing or batch, it is stopped by the action of an electric switch in the control box. The small auxiliary screw is mounted immediately underneath the main feeder and feeds in what is known as the "dribble stream" or final small flow necessary for accuracy. This smaller screw continues to run after the main screw has stopped, the dribble screw in turn being stopped automatically when the exact weight of cement has been delivered to

end. Weights are placed on the weight carrier and the poise is set for any predetermined weight within the range of the scale.

No. 21 Is the First of New Anchor Line of Products Mixers

Announcement is made of a new mixer designed especially for use in concrete products plants and embodying many new features of construction. The Anchor products plant mixer is supported by a heavy two-piece cast iron frame which, by eliminating skids, leaves the space below the discharge door free of obstruction.

Other features of the drum are the conveniently located water distribution line across the top, the protective grid over the opening on the charging side and the heavy steel shelf on which the cement man can rest his bag of cement in the charging process.

The No. 21, which is the first model of this new line of mixers to be placed in production by the manufacturers, the Con-

solidated Concrete Machinery Corp., Adrian, Mich., has a rated capacity of 21 cu. ft. but will handle 26 cu. ft. without spilling. This model is built for permanent installation with either motor or pulley drive.

New Electric Tool Hammers, Drills and Grinds

Holes up to 1 inch diameter can be hammered in concrete or holes up to $\frac{1}{8}$ in. diameter can be drilled in wood by means of a combination tool recently developed by the Milwaukee Electric Tool Corp., Milwaukee, Wis.

It delivers 3600 blows per minute, and will drill a $\frac{1}{2}$ -in. hole in concrete $2\frac{1}{2}$ in. deep; a $\frac{3}{4}$ -in. hole in $1\frac{1}{2}$ in. deep, or a 1-in. hole $\frac{3}{4}$ in. deep in one minute, it is stated. The tool weighs $9\frac{1}{2}$ lbs.

The hammer attachment is constructed with two moving parts, and is made to fit a specially constructed full ball-bearing electric drill operating at an unusually high speed, the manufacturer states. This attachment is so designed that it can be added, without the aid of a screw-driver or wrench, to the drill whenever it is necessary to drill holes in concrete for anchoring machines, etc.

The Universal motor operates on either a.c. or d.c. current and can be made to accommodate 32, 110, 150, and 220 volts.

'Tilt-Weigh' Batcher Weighs and Measures Aggregates

A convenient device for quickly and accurately measuring pre-determined amounts of concrete aggregates by weight has recently been developed by The Knickerbocker Company, Jackson, Mich. It is known as the "Tilt-Weigh" batcher.

Operating entirely independent of the mixer, it can be used to charge any type of mixer equipped with a power loading skip, it is stated. It is positioned in close proximity to the end of the mixer skip and may be charged by the most convenient and practical method conditions permit. If stock-piles are adjacent, materials may be shoveled in. If stock-piles are not close enough for this method, materials may be wheeled and dumped into the batcher hopper from a low platform easily constructed of wood. Certain unusual layouts would permit spouting of materials, but ordinarily the wheeling method is most practical, especially on bridge construction.

"Tilt-Weigh" Batcher is built in two sizes—2-bag and 3-bag— $1:2\frac{1}{2}:4$ mix. The hopper of the 2-bag size will hold 13 cu. ft.—the 3-bag $19\frac{1}{2}$ cu. ft.

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